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Abstract This study evaluated the effectiveness of a family-centered feeding intervention, Easing Anxiety Together with Understanding and Perseverance (EAT-UP™), for promoting food acceptance of children with autism spectrum disorder at home. A concurrent multiple-baseline design was used with systematic replication across three families. Baseline was followed by an ‘Intervention-Coaching’ phase and then an ‘Intervention-Independent’ phase. Using direct observation and pre- and post-intervention questionnaires, data on acceptance of less preferred foods and challenging mealtime behaviors were collected. Procedural fidelity was monitored throughout all study phases. Data were analyzed using visual analysis and measures of effect size. All children demonstrated increases in food acceptance (effect size >0.90) and dietary diversity and decreased challenging behaviors. Implications for practice and research are discussed.

Keywords Autism spectrum disorder · Parent implemented intervention · Mealtime behaviors · Food refusal · Evidence based practices

Introduction

Feeding and eating difficulties among children with autism spectrum disorder (ASD) are increasingly being recognized as an integral part of the disorder (e.g., Cermak et al. 2010; Edmond et al. 2010). The growing body of research in this area has provided information to establish evidence-based practices (EBPs) to support mealtimes, particularly through the use of therapists or other professionals as the interventionists. There is limited information regarding the efficacy of multicomponent interventions that are implemented by parents using these established EBPs.

Parent implemented intervention (PII), in which a parent learns to provide intervention in their home or community through a guided training program, is an EBP for use with young children to make the behavior change sustainable across time and outcome areas (Moes and Frea 2002; Wong et al. 2013). Studies such as one conducted by Johnson et al. (2015) examined the use of parents as interventionists through strategies such as clinic-based behavioral training programs. However, the majority of studies related to promoting mealtime behaviors involve an interventionist working directly with the child and may or may not have a family training component. In fact, a comprehensive synthesis of treatment outcomes in feeding interventions by Sharp et al. (2010) indicated that only 58.3% of the interventions documented caregiver training and over 80% of the studies had trained professionals, rather than parents, providing the intervention. Additional research is needed to determine appropriate methods for integrating PII and feeding interventions to make lasting changes for children and their families.

The current research has examined the efficacy of specific strategies and intervention approaches, such as behavioral strategies, sensory strategies, and communication...
interventions. The majority of the research in the area of feeding and eating difficulties in ASD is focused on specific behavioral strategies to ameliorate difficult behaviors at mealtimes (for a review see Volkert and Piazza 2012). These evidence based practices (EBPs) include strategies such as: functional assessment (e.g., Gale et al. 2011); positive, differential, or non-contingent reinforcement (e.g., Allison et al. 2012); and escape extinction (e.g., Galensky et al. 2001). Several researchers have addressed the possible behavioral functions of food avoidance and challenging mealtime behaviors (e.g., Gale et al. 2011). Although identifying the clear functions of these behaviors is extremely important within research and clinical contexts, in natural contexts it may not always be appropriate or feasible for parents to fully evaluate the function of a particular behavior. While many of the current feeding interventions are behavioral and include assessment of function, it is often difficult to decide which interventions are most appropriate to address challenging mealtime behaviors and thus, require multi-disciplinary assessment and treatment (Sharp et al. 2013; Tanner et al. 2015).

A number of authors have described the impact of a child’s sensory processing characteristics on food selectivity and subsequent mealtime behaviors (see Cermak et al. 2010 for a review). Sensory factors, such as the taste, texture, or appearance of foods, can influence an individual’s behavioral response to foods, leading to food refusal, gagging, vomiting, etc. Researchers in this area have focused on manipulating food (Ahearn 2003) or using sensory-based interventions to support the child (Adison et al. 2012). Other interventions that have been found to be effective in supporting the mealtimes of children with ASD address both behavioral and sensory components of feeding, such food chaining (Fishbein et al. 2006) and changing bite size and/or number of bites (e.g., Sharp et al. 2010), as well as changes to the physical environment, such as seating and type of plate (e.g., Gale et al. 2011; Gentry and Luiselli 2007). Communicative strategies such as functional assessment and functional communication training with children with ASD and their families has been found to be effective in reducing the occurrences of challenging behavior (Moes and Frea 2002; Wong et al. 2013), but have not been explicitly investigated during mealtimes. Additionally, visual support strategies to support a child’s receptive understanding and promote appropriate behavior during meals have been used as part of intervention packages (e.g., Binnendyk and Lucyshyn 2008). However, these communication strategies have not been explicitly investigated during mealtimes and have not been used to address the complex, dynamic communication interactions that occur between the parent and the child.

Most of these studies and other research conducted in the area of promoting mealtime behaviors has focused on identifying specific variables that are responsible for behavior change. For example, studies have evaluated the efficacy of one specific strategy or of one strategy in comparison to another (e.g., Ahearn 2003; Peterson et al. 2016). These studies have contributed to the knowledge base regarding EBPs, but typically do not focus on the complex, dynamic nature of naturally occurring family mealtimes. So although they are able to demonstrate efficacy from a research perspective under controlled conditions, the success of the intervention in a more natural context is not as clear. Additionally, as discussed, most of the interventions addressed in published research approach feeding difficulties as residing in the child, with either behavioral or sensory explanations for the challenges. More recent research (e.g., Chao and Chang 2016; Estrem et al. 2016) recognizes that feeding difficulties impact both child and parents and supports a more comprehensive approach to addressing mealtime behaviors. In other words, although it can be important to systematically control for all variables in the early stages of research examining EBPs, after a practice has been established to be effective in controlled settings, it is also important to evaluate its efficacy in more natural settings, which often includes the use of multiple interventions simultaneously to promote progress.

In order to address the dynamic nature of eating, feeding and mealtimes, the components outlined above are the focus of the current study. For clarity when talking to the parents, the components were organized as (a) social environment (use of behavioral interventions, such as reinforcement, prompting strategies, etc.), (b) physical environment (positioning, etc.), (c) food characteristics (primarily sensory manipulations, such as the types of food provided at meals/snacks); and (d) dyadic communication supports (both receptive and expressive for both the parent and the child). These components provided a framework for the menu of intervention options for parents when individualizing their intervention and directly addressed the unique dynamics of each family in the study. As outlined above, a number of researchers have evaluated these components in isolation or by grouping one or two components together. However, interventions looking holistically at the mealtime environment related to all of those areas have not been explored, particularly in the context of family-as-interventionist.

The purpose of this preliminary study was to expand on the research outlined above and to determine the efficacy and perceived intervention acceptance (social validity) of EAT-UPTM, a parent-implemented multicomponent intervention package designed to improve the mealtime performance of children. This study specifically examined the efficacy of EAT-UPTM with children with ASD.
Method

Participants

Three boys from diverse backgrounds who were diagnosed with ASD (Blake, Craig, and Dominic) and their families participated in this study. Each of the boys had received a diagnosis of ASD prior to his third birthday by interdisciplinary teams, meeting criteria for autism according to the World Health Organization, ICD-10, (1992).

The children were recruited from a statewide interdisciplinary feeding clinic. Families were provided information about the study by the second author and completed a screening to determine eligibility for participation. To be included in the study, the family had to live within 30 miles of the clinic and have at least one parent who was proficient in English. The child had to have a multidisciplinary diagnosis of ASD, be between the ages of 2 and 9 years old, have no medical contraindications for oral feeding, and have significant behavioral difficulties around mealtimes. Significant behavior difficulties were assessed using the Brief Autism Mealtime Behavior Inventory (BAMBI) (Lukens 2005) and were defined as a total score >45, which corresponds to a score that is >+2 SD from the mean for children who are typically developing (Lukens 2005). Upon completion of the screening, if they met the inclusion criteria for the study, families were provided with more detailed information about the study and the opportunity to provide informed consent to participate. Informed consent was obtained from all individual participants included in the study. Because of their age and language abilities, the children were not asked to provide assent for participation. This study was approved by the University of New Mexico Human Research Protection Office.

Blake was a 6-year-old White, Hispanic boy who lived with his married parents and several siblings. He had two older siblings and two younger siblings when the project began, with a baby born towards the middle of the project. His father worked full-time out of the home and his mother worked part-time, mostly from home. His family typically ate together at a dinner table, with the expectation that everyone eat the same meal. Blake would stay at the table for very short periods of time and often would not eat any of the dinner. He would eat granola bars and other “snack foods” during non-meal times. His parents’ primary goals were (1) increase his participation in family mealtimes, (2) incorporate vegetables into his diet, and (3) decrease challenging behaviors (leaving the table and banging his head with his hand to communicate refusal). Both of his parents were targeted as interventionists and they worked together to support Blake and the other children during meals.

Craig was an 8-year-old White boy who lived with his married parents. His father typically traveled 1–2 weeks out of every month for work, so it was often just Craig and his mother at home for meals. Craig was an only child and his mother did not work outside the home. Craig typically ate his meals alone at a desk in their living room or while riding in the car to/from therapy sessions. His mother reported that he had him eat alone because he frequently chewed food without swallowing it, then spit the masticated food into his palm, shaped it into a ball, and put it back in his mouth to chew again. He commonly repeated this routine multiple times before ultimately swallowing the food. He primarily ate highly processed and/or fast-food and was very particular about the brand of food. He did not eat any fruits, vegetables, or meats, and was significantly overweight at the time of his initial evaluation at the feeding clinic. His mother was the interventionist and her primary goals were (1) increase his acceptance of healthier foods, (2) decrease his manipulation of masticated foods so that he could eat with his parents, and (3) decrease other challenging behaviors (verbal refusals, licking preferred foods repeatedly, hitting others, and throwing objects).

Dominic was a 7-year-old African-American boy who lived with his mother, grandmother, and grandfather. He was an only child and his mother was a single mother. His mother worked full-time outside the home, typically evenings and weekends, so his mother and grandmother shared caregiving responsibilities relatively equally. Both of his grandparents also worked outside the home. Dominic’s diet consisted of crunchy and sweet food, as well as a nutritional supplement drink and large quantities of milk. He would not eat any fruit or vegetable and he disliked food that was wet (e.g., apple slices). Everyone in the family ate meals at different times and was on a different specialty diet (e.g., gluten-free), so meals did not have a social component at his house. Dominic most often ate dry cereal, cookies, and chips in front of the television. Dominic’s mother and grandmother were both the interventionists and their primary goals were (1) increase the number of foods he would eat and (2) decrease challenging behaviors (verbal refusals, overstuffing of his mouth, and hiding under pillows/blankets). Most often only his mother or his grandmother was home during an intervention session, but if they were both home, they would identify the primary parent for that particular meal or snack.

Setting

All of the sessions were conducted in the family home using the foods and utensils that were typically used by the family during mealtimes. Based on family preference, intervention sessions occurred during mealtimes for Blake and snack times for Craig and Dominic.

Blake’s interventions were at the family dinner table, typically with both parents and all of his siblings present.
On rare occasions, his father wasn’t present for the meal. Craig’s interventions were initially at a small table in the living room, but within the first month of intervention, his mother began expecting him to eat at the family dinner table at least during intervention sessions. Dominic’s interventions, like his meals and snacks, took place in a variety of places within his house, including in front of the television, on the living room floor, in his bedroom, and in a hallway. Over the course of the intervention, an increasing number of sessions occurred at a small corner of the dining room table that had been cleared specifically for the sessions with the researchers.

**Experimental Design**

A mixed-methods quantitative design was used to examine changes in mealtime behaviors of the child and his parents (i.e., Craig’s mother, Blake’s mother and father, and Dominic’s mother and grandmother). This study used both single-case experimental design (i.e., single subject research design) and pre-/post- measures to document changes in child and parent behavior over time. The use of the two types of data collection methods allowed for triangulation of our findings, providing support for the conclusions both through parent report and through direct observation.

Single subject data collection for this project was developed following the recommended practices for single-case experimental research (e.g., Wolery 2013). A concurrent multiple-baseline design with replication across participants was used to document changes in the children’s food acceptance by direct observation. In this study, reversals of the target behaviors were unlikely, so the multiple baseline design was used to demonstrate causality. The baseline phase was limited to 5–6 sessions per participant because this number of sessions provided adequate documentation of the stability of the children’s behaviors (Gast and Ledford 2010) without unnecessarily prolonging the delay in implementing intervention and risking further behavioral and/or nutritional difficulties. Following baseline, Phase 1 was an Intervention-Coaching phase during which the parent was trained to implement the interventions with coaching and post-session feedback. When the parent independently implemented 90% of the intervention strategies each session over three consecutive data sessions, they would begin Phase 2, which was an Intervention-Independent phase. During this phase, the coaching was eliminated but the post-session feedback continued. Phase 2 was terminated after the child met a level of food acceptance score greater than 85% based on their individualized food acceptance hierarchy across three consecutive data days or after 5 months of intervention, whichever came first. Neither randomization nor blinding strategies were used in this study. The decision was made to start the intervention at the same time for all families rather than randomly assigning them to staggered baseline and intervention phases because of the families’ expressed urgency for intervention.

Procedural fidelity data were collected on the parents’ implementation of the intervention during every session. Using a variety of questionnaires, quantitative data were collected prior to the initiation of the intervention and upon completion of the intervention period to document the children’s food acceptance and their parents’ perceptions of mealtime behaviors, as well as the parents’ perceived acceptance of the intervention.

**Interobserver Agreement**

Interobserver agreement (IOA) between the authors was established prior to the interventions using video tape of evaluations conducted at the feeding clinic. IOA was established across three variables: ‘less preferred opportunities,’ ‘less preferred points on hierarchy,’ and ‘parent behavior.’ IOA was considered adequate when agreement reached 90%. Through direct observation of sessions, IOA was collected for an average of 34.1% of the total sessions per participant (range 31.0–38.5%), with IOA sessions distributed relatively evenly across study phases.

**Data Collection**

Data to assess the effectiveness of the intervention were collected at various points throughout the study. Prior to the onset of intervention and again after the completion of the intervention phase, each child’s mother completed questionnaires related to his mealtime behaviors, food acceptance/dietary diversity, and family quality of life. The children’s mealtime behaviors were assessed using two questionnaires: the BAMBI (Lukens 2005) and the Behavioural Pediatrics Feeding Assessment Scale (BPFAS) (Crist Ford 2013). Both measures use anchored Likert-scales, are quick to administer, and have been used in other studies to assess the parent’s perception of mealtime behaviors. The children’s food acceptance and dietary diversity were assessed through the use of a Food Frequency Questionnaire (adapted from Harvard School of Public Health 2012) and a 24-h food recall (adapted from Lukens 2005). The Food Frequency Questionnaire (FFQ) provides parents with a list of approximately 150 foods, asking them to indicate if each food had been presented to the child in the previous 6 months and, if so, if the child rejected it or how often they ate it. In addition, they were asked to document everything that their child ate in one 24-h period (Lukens 2005).

In addition to these data, data on the child’s food acceptance and the parent’s behaviors were collected during every session throughout the study. The researchers developed
coding sheets to document the food available to the child and the child’s interaction with the food based on a food acceptance hierarchy. Data were collected throughout the course of a meal or snack, as defined by the parent, so the number of opportunities per session varied greatly. A bite opportunity was defined as beginning when either the parent or the child initiated interaction with the food and ending when both the parent and the child ceased interaction with the food. At the end of every session, the researcher completed a feedback sheet for the parent that documented the parents’ implementation of the intervention strategies. These feedback sheets were shared with the parent during the Intervention and Maintenance phases.

To assess the acceptability of the intervention strategy by the child’s parent, a goodness-of-fit survey that used an anchored Likert-scale (adapted from Albin et al. 1996) was distributed to the parent before the intervention began and after the intervention period ended, as well as a Family Quality of Life Scale (Hofman et al. 2006) that evaluates multiple aspects of quality of life for families that include an individual with a disability. All three mothers responded to these surveys.

**Procedures**

**Individualization of Intervention Targets and Strategy**

The authors facilitated the intervention for all three families. Prior to baseline, the researchers met with each family to identify the primary intervention goals for their child. Additionally, at this stage in the study, data were collected regarding the child’s food consumption (using the 24-h food recall and FFQ), as well as mealtime behaviors (using BPFAS). During baseline, data were collected on the intervention targets identified and on a wide variety of potential intervention strategies that the parent could use. At this time, a food acceptance hierarchy was also individualized for each child based on his individual patterns of accepting new foods (see Table 1).

Following baseline, the researchers met with each child’s parent to finalize the goals and to develop an individualized intervention plan that would collectively address the child’s needs, fit within the family routines, and utilize strategies that addressed the family’s strengths (see Table 2). As discussed previously, the same two general goals related to increasing dietary diversity (the total number of foods accepted) and decreasing challenging behaviors were identified by all three families. The specific foods introduced and the challenging behaviors to target were individualized for each family. All three of the family’s intervention plans included interventions in four areas: food characteristics, dyadic communication supports, physical environment, and social environment. See Table 2 for a complete accounting of the interventions that were selected by each family. Food characteristics included strategies to increase the variety of foods presented, recognize the sensory characteristics of the foods being presented, and increase the consistency of presentation of less preferred foods. Dyadic communication supports included strategies to promote communication between the parent and child, including giving the child a voice in the process and ensuring that the parent was communicating appropriately and effectively. Physical environment strategies were designed to ensure appropriate positioning and use the physical environment to promote attention, compliance, and reciprocal interactions. Finally, social environment strategies were intended to support positive parent–child interactions around meals and food, including avoiding power struggles and ensuring clear communication. There were several intervention strategies that were consistent across all three families, but each

### Table 1 Individualized food acceptance hierarchies and associated point scores

<table>
<thead>
<tr>
<th>Point Scores</th>
<th>Blake</th>
<th>Craig</th>
<th>Dominic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Anything lower than “touches with tool”</td>
<td>Anything lower than “tolerates on table/plate”</td>
<td>Anything lower than “touches with tool”</td>
</tr>
<tr>
<td>1</td>
<td>Touches with tool</td>
<td>Tolerates on table/plate</td>
<td>Tolerates on table/plate</td>
</tr>
<tr>
<td>2</td>
<td>Touches with hand</td>
<td>Touches with tool</td>
<td>Touches with tool</td>
</tr>
<tr>
<td>3</td>
<td>Touches to face</td>
<td>Touches with hand</td>
<td>Touches with hand</td>
</tr>
<tr>
<td>4</td>
<td>Touches to lip(s)</td>
<td>Touches to face</td>
<td>Touches to face</td>
</tr>
<tr>
<td>5</td>
<td>Touches to teeth</td>
<td>Touches to lip(s)</td>
<td>Touches to lip(s)</td>
</tr>
<tr>
<td>6</td>
<td>Touches with tongue</td>
<td>Touches to teeth</td>
<td>Touches to teeth</td>
</tr>
<tr>
<td>7</td>
<td>Food hovers in mouth</td>
<td>Touches with tongue</td>
<td>Touches with tongue</td>
</tr>
<tr>
<td>8</td>
<td>Spits bite out</td>
<td>Spits bite out</td>
<td>Spits out small bite</td>
</tr>
<tr>
<td>9</td>
<td>Spits bite out after delay</td>
<td>Swallows small bite</td>
<td>Swallows small bite</td>
</tr>
<tr>
<td>10</td>
<td>Chews once, spits it out</td>
<td>Swallows typical bite</td>
<td>Spits out typical bite</td>
</tr>
<tr>
<td>11</td>
<td>Chews &gt;1x, spits it out</td>
<td>–</td>
<td>Swallows typical bite</td>
</tr>
<tr>
<td>12</td>
<td>Swallows bite</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
family also had strategies specific to their situation (see Table 2).

**Baseline**

During baseline sessions, the parent was asked to provide a meal or snack to the child under usual circumstances. The researcher(s) observed the meal/snack to collect data on parent and child behavior, but no instruction on mealtime interventions was provided to the children or their parents. Blake and Craig each had five baseline sessions and Dominic had six.

**Intervention-Coaching**

During the first part of the intervention phase of the study, one researcher coached the parent through the meal/snack to increase the child’s food acceptance. Coaching continued until the parent demonstrated the ability to independently implement at least 90% of the intervention strategies each session across three consecutive data sessions. This phase of the intervention lasted for 9–21 sessions, depending on the needs of the family (Craig = 9, Blake = 11, Dominic = 21). Strategies such as demonstration, verbal instructions, and visual supports were used to teach the parents to implement various strategies. Significant efforts were made to maintain the interaction between the child and the parent, so most of the coaching was conducted verbally while the parent was implementing the strategy. Occasionally it was necessary for the researcher to teach a technique outside of the meal or snack. Parents were asked to implement the intervention throughout the week, but were not required to document the use of the interventions outside of the data collection sessions. The researchers emphasized that the parents had ownership of the intervention and were free to decide how often to implement it throughout the week, with the understanding that more frequent implementation would likely lead to faster progress. At the end of each

### Table 2 Components of individualized intervention plans for each family

<table>
<thead>
<tr>
<th>Intervention strategy</th>
<th>Child</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offer foods from three food groups</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Select foods he is likely to learn to eat (texture, color, shape, etc.)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Present both preferred and less-preferred foods at each snack/meal</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Dyadic communication</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use picture menu or verbal choices for child to select foods to eat</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Promote communication during meals</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use visual supports for “first/then”</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Follow through with use of “first/then”</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use more commands/statements than requests for less preferred foods</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use visual food acceptance hierarchy</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Help child appropriately communicate ideas like, “I don’t want that”</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Physical environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eat meal/snack at specified table</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use appropriate seating (e.g., booster seat)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stay at the table with the child</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Position adults/siblings near child</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remove distractions from environment</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keep TV/tablets off for at least 30 min</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Increase expectations for time at table</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Social environment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintain a generally positive tone</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use positive reinforcement</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Encourage exploring less preferred foods</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Limit to two verbal prompts before helping child meet hierarchy target</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Follow through on expectations you set</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stay focused on goal of food consumption</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use siblings as peer models</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use token-based system</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

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coaching session, the researcher would provide the parent with written feedback regarding implementation of the target strategies and recommendations for strategies to support the child until the next research session.

As discussed, Table 2 provides an overview of the intervention strategies that each family included in their intervention package. Overall most of these strategies have been described elsewhere and reflect general strategies used to promote behavior change and food acceptance (e.g., use of a positive tone throughout the meal, gradually increasing expectations, etc.). A few elements of the intervention appear to be somewhat unique to EAT-UP™ and require further explanation. First is the use of a verbal or visual menu to allow the child to select the less-preferred food he wanted for a meal or snack each day, supporting active involvement by both the child and the parent in the mealtime. In general, the parent would provide the child with two choices of less preferred foods. If the child didn’t choose between the two, the parent would make the choice. Blake’s family did not select this strategy because everyone was expected to eat the same thing and none of the children were given a choice of foods. Second was the use of a visual hierarchy. These individualized hierarchies presented the expectations outlined in Table 1 using color photographs (matching approximate age, gender, and race of child) and simple text. Each hierarchy had an arrow that was moved to maintain a visual reminder of the target level that needed to be reached before a reinforcer would be provided. This strategy was selected because the use of visual supports is an established EBP for children with ASD (e.g., Wong et al. 2013) and it provided a concrete way for parents to support the child’s sensory exploration of the food through systematic desensitization (e.g., touching with a tool, touching with a hand, etc.). Finally, under the social environment category, parents were expected to stay focused on food consumption as the ultimate goal. In other words, there was an expectation that the child would move up the hierarchy within and across sessions, not simply be permitted to explore the food through play. Parents were trained to use strategies such as high probability requests, physical prompts, siblings as peer models, and positive reinforcement to move the child toward food consumption.

Intervention-Independent

Once the parent demonstrated the ability to independently implement at least 90% of the intervention strategies across three consecutive data collection sessions, they moved into the Intervention-Independent phase. During this phase, no support was provided to the parent during the meal/snack. The researcher observed the meal/snack to collect data regarding the child’s food acceptance and the parent’s use of mealtime strategies they had been taught during the Intervention-Coaching phase (e.g., visual supports, positive reinforcement, functional communication, etc.), but provided no additional guidance. At the end of each session, parents were provided with verbal and written feedback regarding the strategies they had implemented successfully, as well as reminders to use strategies they didn’t implement appropriately during that meal/snack. The Intervention-Independent phase of the study ended when the child met a level of food acceptance score greater than 85% based on their individualized food acceptance hierarchy across three consecutive data days or after 5 months of intervention, whichever came first. Craig and Blake both moved into maintenance based on high levels of food acceptance (Craig required three sessions and Blake required eight). Given the length of time Dominic and his parents were in the Intervention-Coaching phase, he only completed one independent session before he reached the 5 month study endpoint.

Maintenance/Generalization

Generalization data were planned for all families, but by the end of baseline they all had indicated that they were unable to identify naturalistic opportunities for generalization. They said that the children only ate at home or at school, and none of them were interested in pursuing increased food acceptance at school at the end of baseline. As a result, we were unable to collect any generalization data. However, as we will discuss, Craig’s mother ultimately attempted to increase his food acceptance during school lunch using strategies she had found to be effective at home. Follow-up maintenance probes were collected for all families beginning after the completion of Intervention-Independent and continuing until the family had been involved in the research study for 6 months. Dominic had two maintenance probes, Blake had three, and Craig had six.

Reliability

Interobserver agreement between the two researchers was obtained to evaluate both procedural fidelity of the researchers and the dependent variable reliability (for parent and child) during baseline, intervention, and maintenance phases of the study.

Results

Child Outcomes

Direct Observation of Food Acceptance

Figure 1 illustrates the children’s acceptance of less-preferred foods as measured by percent of points obtained
on a food acceptance hierarchy during baseline, intervention, and maintenance. Points were assigned to each less-preferred food bite opportunity based on the level the child obtained on their personalized food acceptance hierarchy, with higher points representing a higher level of acceptance (see Table 1). The number of points obtained per session was divided by the total number of points possible for that session (maximum number of points on hierarchy multiplied by the total number of less-preferred bite opportunities) and multiplied by 100 to obtain a percent of hierarchy score for each session.

During baseline, all participants demonstrated low levels of acceptance of less-preferred foods, with mean acceptance of 0% (Dominic), 17% (Craig), and 20% (Blake). Craig demonstrated stable levels of food acceptance until his final baseline session. Although he swallowed five very small bites of banana that day by scraping the fruit against his teeth, the total amount consumed was much less than one teaspoon and only reflected 3% of his total snack that day (as measured by number of opportunities). The decision was made with his parent to continue into the intervention phase of the study despite this apparent spike because the behavior observed was consistent with the other behavior observed—Craig’s acceptance of the less preferred food was neither functional nor appropriate and reflected an area of concern for his parent. Blake demonstrated consistently low but somewhat variable performance during baseline, which his parents reported was typical. They indicated that he would taste things sometimes and completely refuse them other times.

Visual inspection of the data during intervention demonstrate increased levels of acceptance from baseline to

![Fig. 1 Child food acceptance by session day as presented by percent of the hierarchy met and percent of parent implementation of target behaviors by session day. Note child data is missing for Blake on session day 149 due to incomplete data collection that day. The gap in data for Blake from day 94 to day 134 was when his mother gave birth to a baby and the family requested a break from data collection sessions.](image-url)
intervention, with increasing trends across the intervention phase for all children, indicating that the children demonstrated improvements in their acceptance of less-preferred foods. The immediacy of the effect of the intervention is clearly reflected in the transition from baseline to intervention for all children. In addition, food acceptance levels during maintenance remain much higher than food acceptance during baseline for all three children.

A number of different methods can be used to evaluate intervention effectiveness, including percentage of non-overlapping data points (PND) (Scruggs et al. 1987), percentage of data points exceeding the median (PEM) (Ma 2006), and Tau-U (Parker et al. 2010). In this study, the PND across baseline and intervention was 75% for Craig, 84.2% for Blake, and 100% for Dominic, suggesting that the intervention was fairly effective to highly effective in supporting the food acceptance of all three children. It is important to note that the PND data for both Craig and Blake are somewhat skewed due to one outlying data point during baseline for each boy. This single outlier of relatively high acceptance of less-preferred foods resulted in more overlap in the data than is reflected by examining the data as a whole. PEM, another measure of effect size, yielded scores of 1.0 for all three children, indicating a highly effective treatment effect. Finally, Tau-U, which is a non-parametric technique that can be used to measure data non-overlap between phases that includes both non-overlap between phases and trend within intervention were calculated for this data set both with and without correcting for a potential baseline trend for Craig. In both instances, the Tau-U was greater than 0.90 (0.93 and 0.92, respectively; \(p < .00001\)), indicating a 92–93% increase in performance during intervention over baseline.

**Food Diversity**

Based on parent responses on the FFQ, all of the children demonstrated increases in the number of foods they accepted. The children added an average of 14 foods as reflected in the pre- and post-intervention testing (Dominic = +6, Craig = +16, Blake = +20). These increases include adding main dishes and fruits/vegetables, both of which were identified as areas of need by the children’s parents. Figure 2 illustrates the percent change in the number of foods the children accepted after intervention in comparison to pre-intervention. Blake and Craig demonstrated acceptance of an increased number of foods in all food categories. Dominic’s apparent acceptance of fewer drinks and snacks/desserts is consistent with his family’s changes regarding the foods they provide to him. Specifically, they had decreased their offering of foods like potato chips and corn chips in an attempt to encourage more diverse food consumption. The 24-h food recall interviews supported the findings of the FFQ, reflecting increased dietary diversity and a move towards healthier foods (e.g., fruits, meats, and nuts instead of potato chips and cookies) for all three children.

**Mealtime Behaviors**

All three children’s parents reported a decrease in their child’s challenging mealtime behaviors, as measured by the BAMBI (see Table 3), with \(z\) score decreases of >0.6 (Dominic), 0.8 (Blake), and >1.8 (Craig). In addition, the number of reported problem behaviors decreased for all of the children.

Results of the BPFAS are fairly similar to the BAMBI for Blake and Craig. Their parents reported decreased frequency of problem behaviors and identified a lower number of problem behaviors after intervention (see Table 3). Dominic, however, demonstrated a different pattern of scores. His frequency of problem behaviors score was unchanged from pre-intervention to post-intervention on this measure and his mother identified a much greater number of problem behaviors post-intervention than she did pre-intervention (\(z\) scores = +0.6 and >+3.0, respectively). This is likely due to an increased awareness of typical child eating behaviors, as we will discuss later in this report.

**Parent and Family Perceptions and Outcomes**

**Direct Observation of Parent Behaviors**

Figure 1 illustrates the parents’ implementation of each child’s individualized intervention plan. Because of the nature of these mealtime interactions, the parents in each family are considered together. For example, the data are not graphed separately for Dominic’s mother and grandmother. Instead, given the interchangeability of his
mother and grandmother at meals, both are considered a parent unit and their behaviors are presented as one. As illustrated, each parent initially demonstrated relatively low levels of desired behaviors, with mean levels of 17.8% (Dominic), 34% (Blake), and 36% (Craig). Visual analysis of the data indicate an upward trend for all parents, with levels approaching or achieving 100% during the independent intervention and maintenance phases. The PND were 79% (Dominic), 94% (Blake), and 100% (Craig) from baseline to intervention. As anticipated, overlapping data were most common during the coaching phase of the intervention (PND range 76.1–100%). There were no overlapping data when both the Intervention-Independent and maintenance phases were compared to baseline (PND = 100%). The PEM for all parents was equal to 100% across all phases of the study.

The Tau-U were calculated for this data set both with and without correcting for potential baseline trends for Blake’s and Craig’s parents. In both instances, the Tau-U value was greater than 0.90 (1.03 and 0.97, respectively; p < .00001), indicating a significant increase in performance during intervention over baseline.

### Table 3 Pre- and post-intervention mealtime behaviors

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Blake Time 1</th>
<th>Blake Time 2</th>
<th>Craig Time 1</th>
<th>Craig Time 2</th>
<th>Dominic Time 1</th>
<th>Dominic Time 2</th>
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</thead>
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<tr>
<td>Total z score</td>
<td>+2.4</td>
<td>+1.6</td>
<td>&gt;+3.0</td>
<td>+1.2</td>
<td>&gt;+3.0</td>
<td>+2.4</td>
</tr>
<tr>
<td>Number of problem areas</td>
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<td>0</td>
<td>13</td>
<td>9</td>
<td>12</td>
<td>8</td>
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<tr>
<td>BPFAS Child-directed Items</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency z score</td>
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<td>+0.8</td>
<td>+1.3</td>
<td>+0.2</td>
<td>+3.0</td>
<td>+3.0</td>
</tr>
<tr>
<td>Problem areas z score</td>
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<td>−0.1</td>
<td>+1.8</td>
<td>+0.9</td>
<td>+0.6</td>
<td>&gt;+3.0</td>
</tr>
<tr>
<td>Parent-directed items</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency z score</td>
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<td>+0.6</td>
<td>+2.2</td>
<td>+0.8</td>
<td>+2.9</td>
<td>+1.6</td>
</tr>
<tr>
<td>Problem areas z score</td>
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<td>+0.1</td>
<td>&gt;+3.0</td>
<td>+0.8</td>
<td>+0.8</td>
<td>+1.4</td>
</tr>
</tbody>
</table>

### Parent Perception of Managing Challenging Behaviors

Results of the BPFAS for the parents indicated that they all reported fewer feelings of frustration, anxiety, etc., related to mealtimes after the intervention. In fact, the parents’ z scores for the frequency of problematic parent behaviors were all below +1.0 following intervention (range +0.1 to +0.8), even though they were all above +1.0 prior to intervention (see Table 3). As with the parents’ identification of child mealtime problem behaviors, only Dominic’s parent reported an increase in the number of problematic parent behaviors, with an increased z score from +0.8 to +1.4. The other parents reported strikingly fewer problematic parent feelings/behaviors after intervention (see Table 3).

### Social Validity of Intervention

No adverse events involving any of the participants of the study were observed or reported. Two measures were used to evaluate the social validity of the intervention at two points in the study. At both time periods, all three mothers indicated that the intervention strategy reflected their family’s goals and priorities while addressing their strengths and needs. The mothers reported that they felt that they would be able to implement the intervention plan as directed, but were not confident that they would be able to instruct others (like teachers or grandparents) on how to follow the plan. Overall the mothers were satisfied with the intervention plans at both points in the study.

At the onset of the project, the parents verbally indicated high levels of stress around mealtimes and concern for their child’s health because of his mealtime behaviors. However, all of the families reported relatively high levels of family quality of life at both the onset and conclusion of the intervention as measured by The Family Quality of Life Survey (Hoffman et al. 2006). It is important to note that this survey does not directly measure mealtime behaviors and may not be sensitive to mealtime behavior change or the impact of mealtime difficulties on overall family quality of life. The results of this survey don’t reflect the high levels of frustration during mealtimes captured by the other measures, i.e., BAMBI and BPFAS. However, all of the parents reported high levels of family quality of life, with very little changes from pre- to post-intervention, suggesting that the intervention did not have a negative impact on their family’s quality of life.

### Reliability

IOA data were collected for a mean of 35.1% of sessions for each family (range 32.1–38.5%), with IOA sessions distributed across phases. Mean IOA levels for child behaviors exceeded 90%, including opportunities for less preferred
foods (range 92.2–96.8%) and hierarchy points for less preferred foods (95.3–98.8%). For parent behaviors, the mean IOA for Blake and Craig were 97.2 and 97.5%, with IOA for Dominic’s parents at 88.2%. Procedural fidelity for the coaches (researchers) was rated at 100% across all data sessions.

**Discussion**

There are a number of EBPs that have been found to increase the food acceptance of picky eaters, including children with ASD (Volkert and Piazza 2012), however, much of the research has been conducted in clinical settings and/or with a professional acting as the interventionist. This study examined the efficacy of EAT-UP™, a mealtime intervention that couples the use of EBPs with the education and training of parents as primary interventionists. Specifically, this study examined EAT-UP™ in the context of supporting families of children with ASD in the most natural setting possible: the home. As such, this study corroborates some of the previous findings of the need for the use of EBPs while adding to the literature about the usefulness of parent implemented interventions, particularly with regard to changing mealtime behaviors and promoting food acceptance.

There are several explanations for the success of EAT-UP™ with these families. The emphasis placed on integrating the intervention within the context of each individual family, ensured strong social validity throughout the project. Parents were actively involved in the development of the intervention, selecting the goals and strategies that were most meaningful to them and seemed most practical for their family. This increased their investment in the intervention and ensured that the strategies chosen could be incorporated into their family routines. In addition to incorporating the interventions into the family routines, all interventions occurred in the family home, decreasing the need for generalization of skills from clinic to home. Both the child and the parent had the opportunity to experience the intervention strategies in their natural environment with the support of the researchers who provided additional training and troubleshooting, as needed. Additionally, using the parent as the interventionist minimized the need for generalization of skills across people. Parents were encouraged to present the child with foods that were already part of regular meals in the house to minimize the need for additional planning, food preparation, etc. This strategy was most effective for Blake because there were other children in the home and they were already eating meals together as a family, so he naturally had exposure to a wide variety of different foods. Craig’s and Dominic’s families were also encouraged to incorporate the family’s typical foods into the child’s diet as much as possible. Through the goodness-of-fit measures gathered before and after intervention, the parents indicated that the intervention plan met their needs and that it was a plan that they could implement in their homes, indicating that EAT-UP™ was family-centered and socially valid.

In addition to the emphasis on working with parents to develop an intervention strategy that would fit within their family, the EAT-UP™ intervention used specific strategies to support both child and the parent in successful implementation of the interventions. As discussed, the most salient strategy that was used in this intervention was a visual hierarchy to promote gradually increasing tolerance of less preferred foods. The hierarchy was individualized for each child by only including the tolerance steps that child required. For example, Craig very quickly learned to touch food, pick it up, and put it to his lips without prompting, so his visual hierarchy was reduced to three steps: “small bite, big bite, eat it all.” The visual hierarchies helped the parents remember the sequence of steps so they were able to systematically use the visual steps to prompt their child through increasing expectations of interactions with the foods. The children were systematically desensitized to the less preferred food through the use of the visual hierarchy and reinforcement for successive approximations. They learned the steps of the hierarchy, were able to explore the foods in a non-threatening way through touching and tasting it, and had visual representations of their parent’s expectation to minimize any anxiety related to unclear expectations. The parents were instructed to balance their expectations to ensure that they were gradually increasing expectations without moving too quickly and overwhelming the child. The systematic use of the visual hierarchy, in conjunction with the other elements of the intervention, resulted in Craig eating foods like apples, cashews, and yogurt-covered raisins and in Blake eating vegetables with his family. It is important to note that the boys’ intake of these foods was meaningful to their families. Rather than simply taking a bite or two of the food during structured taste sessions, both families reported that their son was eating age-appropriate servings of the foods as part of their typical diets during naturally occurring meals or snacks. Dominic also learned to eat less preferred food, consuming cheese and crackers and grilled cheese sandwiches while seated at the table. His family was able to decrease their reliance on milk and nutritional supplements during the course of the intervention because of his increased intake of different foods.

In addition to increasing the children’s acceptance of less preferred foods, EAT-UP™ is designed to decrease challenging mealtime behaviors. The parents of the children in this study reported high frequency of difficult mealtime behaviors and above average feelings of frustration prior
to the onset on the study. Following the study, both Craig and Blake parents’ perceptions of problems had moved into the average range (see Table 3). This is supported by the fact that Craig transitioned to eating meals at the table with his mother because he was no longer physically handling previously chewed food and that Blake regularly stayed at the dinner table with the family throughout the entire meal. Dominic’s mother, however, reported a significant increase in her perception of the mealtime difficulties. This may be explained by an increased awareness and knowledge of what typical mealtime behavior might be. Prior to the intervention, not only did Dominic eat most of his meals in front of the television, but his diet consisted almost exclusively of preferred foods, including milk, dry cereal, a nutritional supplement, and chips. During the intervention, she learned more about typical meals for a child his age and began to transition him to more typical foods in a more structured setting (e.g., set meals at the table instead of grazing throughout the day). It is likely that the combination of increased parental expectations and increased knowledge of typical childhood behaviors led to a more accurate reflection of Dominic’s mealtime challenges. Besides the behavior changes reflected on the formal assessments, other positive changes were observed: Craig’s parents reported an increase in functional communication with communicative responses such as “no thank you” replacing aggression and throwing of food items, and Blake’s mother remarked that she finally understood token use for positive reinforcement through the EAT-UP™ study.

Both Blake’s and Craig’s parents originally reported a good fit between the intervention and their family as indicated by factors such as: addressing their priorities, building on the strengths of the family and child, able to be implemented long-term, having appropriate social-emotional supports, and clear expectations of the role of the parent and researchers. For both parents, the ratings either stayed the same or increased from pre- to post-intervention. Early concerns regarding the difficulty of implementation, using family resources, and building on the child’s strengths were reduced following implementation of the intervention, although there continued to be some concern with feeling that others wouldn’t be able to follow through when the primary parents weren’t around. As with the other measures, Dominic’s parent demonstrated a somewhat different pattern of responding. Like the other parents, her overall perception that the intervention was a good fit for their family increased from pre- to post-intervention. She expressed a better understanding of what she needed to do to implement the intervention and perception of the efficacy of the intervention. However, she had decreased confidence that the intervention fit within their family routines and could be implemented long-term. Consistent with the philosophy of single-case experimental design, it is important to evaluate the characteristics of the child/family that related to the outcome we found (e.g., Horner et al. 2005). Dominic’s family had routines and expectations that were quite different from the other families. Although these differences aren’t inherently positive or negative, they do contribute to the efficacy of this intervention and provide information regarding the identification of families who may be appropriately supported through this type of PII intervention. Dominic’s family had very loosely established routines regarding mealtimes, with everyone eating different foods at different locations around the house. This is consistent with observations about the overall parenting style in the home: Dominic’s mother and grandparents did not provide structure or limits to his time at home, allowing him to engage in whatever activities he chose for as long as he chose (e.g., watching television, eating only preferred foods, etc.). They had very loosely defined personal boundaries for Dominic, as evidenced by the way he physically interacted with his caregivers, particularly his mother. So overall, the expectation that the parent would need to be even minimally actively involved in the mealtime and provide some structure and guidance to his meals was difficult for the family to accept. This suggests that an intervention, such as this one, that relies heavily on parent-implementation of semi-structured interventions during family routines may not be effective or appropriate for this family. His mother repeatedly indicated that increased food acceptance was a major goal of hers for Dominic and that she was committed to implementing the intervention, but also reported that little implementation happened in between formal research sessions. The researchers regularly had to prompt his mother’s engagement during the research sessions, including providing on-going reminders that this intervention relied on the parent as interventionist, with coaching (but not direct intervention) from the researchers. Further investigation into her motivations for pursuing the intervention may have provided useful information for identifying alternative intervention strategies. It is possible that strategies that were less routine-based and more heavily dependent on a therapist promoting behavior change, rather than a PII, would have provided the support that this family required to be successful.

Implications

This study has important implications for a variety of professionals who work with children with ASD and their parents. Collectively, the two researchers have formal education and clinical expertise in the fields of occupational therapy, speech-language pathology, special education, and applied behavior analysis. Using strategies from these professional fields in combination allowed for the creation of individualized EAT-UP™ interventions that were
acceptable to and could be implemented by parents. This study supports other research that indicates that PII can be effective in supporting the skills of children with disabilities and provides information on strategies for individualizing the selection and use of EBPs for specific families to capitalize on their strengths and needs. Although much of the research to date has approached feeding difficulties as primarily residing in the child with most interventions directed at changing child behavior, recent articles have highlighted the need for addressing food selectivity in children as a family-based issue that requires family-centered interventions. Estrem et al. (2016) found that families view mealtime challenges as a long-term, persistent family-based journey and Chao and Chang (2016) described that there are patterns of problematic parental feeding behaviors associated with children with food refusal issues, emphasizing the importance of supporting the entire family instead of simply the child. Given the dearth of information on PII in mealtime behaviors (Sharp et al. 2010), as well as the complexities in implementation that we have outlined, it is recommended that professionals consider EBPs in collaboration with other professional fields that include, but are not limited to, those addressed in this EAT-UP™ intervention (i.e., behavior, communication, manipulation of food, and the physical environment).

Limitations and Additional Research

There are several important limitations to this study. Although the families were from diverse backgrounds, the small number of families targeted for this study reduces the generalizability of the study to other families of children with ASD. In order to address this limitation, the authors are planning on conducting additional research in a train-the-trainer model including using professionals (e.g., SLP, OT) as coaches to reach more families of children with challenging mealtime behaviors and food refusal. It should be noted that this intervention was replicated across three individuals who all demonstrated positive outcomes so some causal inferences can be made suggesting that this intervention may be effective for other children with ASD who have limited food acceptance and challenging mealtime behaviors. As discussed, generalization of new behavior to other settings or with other people outside immediate caregivers was not targeted during this study because the parents were unable to identify natural opportunities for generalization. However, as mentioned briefly above, Craig’s mother attempted to carryover the new food acceptance to his school setting. She found that although his food variety increased at home, he wasn’t eating the same foods at school. During the course of the intervention, she had modified his visual hierarchy from one that gave guidance for each individual bite to a written list for Craig that explained what he needed to eat before accessing preferred food. She began to send a written list in his lunchbox that was like the one she used at home, and she reported that he began to eat the new foods at school. Future research is needed to explore the generalizability of the strategies to settings such as restaurants or school cafeterias.

In addition, although the parents indicated that they felt supported by the researchers throughout the process, a more formal social-emotional support format may be beneficial to the families. The researchers observed that Blake’s parents and siblings frequently worked together to prompt each other to implement strategies correctly. They were able to talk to each other about what worked well and what changes they should make during future sessions. Craig’s and Dominic’s families did not have these opportunities for support and learning from someone other than the researchers. Future research in this area should explore the use of parent-to-parent support as parents are learning to implement the interventions.

Changing mealtime behavior is a slow, complex process (Chao and Chang 2016) and this study was limited by time. This was a limitation for Dominic, in particular, as his parents required more coaching than the other parents. It is possible that a more significant change in his behaviors and greater perceived integration into family routines would have been observed with additional opportunities for his parents to implement the interventions independently. Future research is needed that tracks children for longer periods to assess their acceptance of a greater variety of foods contingent on longer intervention periods and consequently, increased support for parents.

Acknowledgments We would like to thank Julia Brunson, Jennifer Hill, Kristi Driggs, Joan Henriksen, and Tara Monroe for assisting with the development of materials and management of data. This paper was presented in part at the annual conference for the American Occupational Therapy Association (2015) and Association of University Centers on Disabilities (2014).

Author Contributions Dr. JC and Dr. DM participated in the study conception, design, implementation of the intervention, collection and interpretation of data, drafting and revision of the article.

Funding This study was funded by internal funding from the University of New Mexico, Department of Pediatrics, Occupational Therapy Graduate Program.

Compliance with Ethical Standards

Conflict of interest Joanna Cosbey declares that she has no conflict of interest. Deirdre Muldoon declares that she has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical
Informed Consent  Informed consent was obtained from all individual participants included in the study.

References


