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Mealtime Behaviors Associated with Consumption of Unfamiliar Foods by Young Children with Autism Spectrum Disorder

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Abstract

Parent and child mealtime behaviors associated with consumption of unfamiliar foods by children with ASD were examined. Families of 38 children aged 2 through 8 years old and diagnosed with ASD videotaped a typical home mealtime during which parents presented the child with an unfamiliar food and mealtime behaviors were subsequently coded through an observational coding system. The child taking sips of their drink was the only behavior related to whether the child took a bite of the unfamiliar food throughout the course of the meal. Parent direct commands and parents feeding the child were related to greater frequency of subsequent bites in a close temporal window, while child play, the child being away from the table, and child talk about things other than food related to lower frequencies of subsequent bites. Clinical interventions for food selectivity in children with ASD might provide parents education on effective mealtime parenting strategies and decreasing inappropriate child mealtime behaviors.

Keywords

food selectivity; mealtime behaviors; autism spectrum disorder

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Introduction

Approximately 80% of young children with Autism Spectrum Disorder (ASD) are described as picky eaters, and 95% of these children are reported by parents to resist trying new foods (Lockner, Crowe, & Skipper, 2008). Children with ASD may display specific eating habits such as requiring foods to be particular textures, colors, shapes, or commercial brands (Cornish, 1998). Although some picky eating and food selectivity are typical and developmentally appropriate for young children (Crist & Napier-Phillips, 2001), young children with ASD have been found to display rates of food selectivity greater than those of their typically developing peers (e.g., Bandini et al., 2010; Provost, Crowe, Osbourn, McClain, & Skipper, 2010). Children with ASD are also more likely to eat a narrower variety of foods within particular food groups (e.g., fruits, dairy products, starches), with children with ASD consuming only half the number of foods in each group as their typically developing peers (Schreck, Williams, & Smith, 2004).

Food refusal and feeding problems have been related to several negative outcomes for children and their families (e.g., Bandini et al., 2010; Kodak & Piazza, 2008). Mealtime problems can impact children's participation in social events, mothers' perceptions of parenting, parent effort required at mealtimes, and mothers' concerns about how they will be perceived by others (Wilkinson, 2009). Further, children with ASD have lower consumption of some important nutrients, such as calcium, protein, vitamins, and fiber (Bandini et al., 2010; Sharp et al., 2013).

Several reasons have been proposed for why children with ASD display high rates of feeding problems. One perspective is that these restricted food preferences are similar to the restricted patterns displayed by children with ASD in other spheres of life (Cornish, 1998). Other characteristics of ASD, such as deficits in social compliance, biological food intolerance, sensory impairments, perseveration, fear of novelty, and difficulty with motor skills may lead to the increased rate of feeding problems in this population (Cumine, Leach, & Stevenson, 2000). Children with ASD also have greater rates of gastrointestinal problems and atypical eating behaviors such as pica (Rutter, 2006), which may contribute to higher rates of feeding problems.

Given the high prevalence of feeding problems in children with ASD and the associated potential negative outcomes, identification of factors related to food refusal in children with ASD is important for developing effective interventions. Prior research has supported an association between parent mealtime behaviors and child feeding problems or diet variety among typically developing children and children with feeding problems (e.g., Faith, Scanlon, Birch, Francis, & Sherry, 2004; Williams, Hendy, & Knecht, 2008). Among children with feeding problems, child diet variety has been associated with fewer parental attempts to increase food consumption (e.g., offering desserts for eating foods, allowing the child's favorite flavors on foods, putting foods in the child's mouth) and greater parental permissiveness (Williams et al., 2008). Parental prompts for eating have also been related to greater food consumption (McKenzie et al., 1991). In addition to parent behaviors, child mealtime behaviors have also been related to food consumption in typically developing children (e.g., Koivisto, Fellenius, & Sjoden, 1994). For example, children's compliance

with taking bites following parent recommendations (e.g., “Have some more potatoes”) has a moderate positive relationship with greater energy intake, whereas parents offering assistance (e.g., “Do you want me to cut your meat?”) has a negative moderate relationship with energy intake (Koivisto et al., 1994). However, research to date has yet to examine whether these associations between mealtime behaviors and diet variety also occur among children with ASD.

Behavioral treatment procedures, such as reinforcement, escape-extinction techniques, physical guidance, and modeling, have been supported by substantial research as effective for treating food refusal, including severe food refusal in children with ASD (e.g., Kerwin, 1999; Kodak & Piazza, 2008). For example, Koegel and colleagues (2012) found that parental use of individualized reinforcement for trying new foods combined with hierarchical exposure to non-preferred foods resulted in greater acceptance of non-preferred foods and spontaneous requests for new foods among young children (6–8 years old) with autism. Additionally, a home-based intervention targeting vegetable consumption in young (2–4 years old) typically developing children found parental use of rewards, modeling, and repeated exposure led to increased vegetable intake (Holley, Haycraft, & Farrow, 2014). Of note, parents only received instruction on behavioral methods at one baseline session, meaning significant improvements were achieved through a cost and time efficient manner. Further, Seiverling, Williams, Sturmey, & Hart (2012) implemented a home-based parent behavioral skills training involving taste exposure, escape extinction, and fading, which led to increased acceptance of bites of non-preferred food by children with ASD during tasting sessions. Parents’ implementation of behavioral skills was also found to improve over the course of tasting sessions, suggesting parents have the ability to incorporate such skills into their parent-child interactions. However, these strategies may not be part of parent’s natural behavior repertoire and, therefore, require parent training and access to trained behavioral or feeding specialists to utilize such techniques.

Less is known about common mealtime behaviors that occur in parent’s natural behavioral repertoire that can be used to address food selectivity. The impact of routine parent mealtime behaviors on getting children with ASD to consume nonpreferred foods has not been previously explored (Ledford & Gast, 2006). Further, a review of the literature on food selectivity within children with ASD found a need for additional research examining factors related to limited diet variety, including aspects of family mealtimes (Cermak et al., 2010).

Parent-focused interventions are frequently used in treatments for children with ASD. For example, parent-focused interventions have been developed to address parenting stress (e.g., Keen, Couzens, Muspratt, & Rodger, 2010), parenting competency for addressing child problematic behaviors (e.g., Keen et al., 2010; Sofronoff, Leslie, & Brown, 2004), and child social communication (Aldred, Green, & Adams, 2004). Parent-focused interventions targeting children with ASD have been found to influence child outcomes such as adaptive functioning (e.g., Keen et al., 2010), language development (e.g., Drew et al., 2002; Aldred et al., 2004), social communication and interactions (e.g., Aldred et al., 2004; Sofronoff et al., 2004), and problematic child behaviors (e.g., Sofronoff et al., 2004). These past findings suggest that parent-focused interventions are appropriate and effective for behavior change among children with ASD.

The current project examined parent and child mealtime behaviors associated with bites of an unfamiliar food (i.e., a food the child had never been presented before to eat) by children with ASD. Identifying typical or routine mealtime behaviors in families may offer targets for behavior change in future interventions to reduce food selectivity in children with ASD. Given pediatric psychologists' expertise in behavior management, they could assist with treatment of feeding problems if typical mealtime behaviors are found to be related to food consumption, which may improve access to treatment for food selectivity given the larger number of pediatric psychologists compared to specialized feeding therapists. Specifically, the following hypotheses were explored: 1) Children who took a bite of the unfamiliar food would differ from children who did not on several child mealtime behaviors, such as food refusal, talk unrelated to food, and play at the table. It was also hypothesized that parent mealtime behaviors would differ between children who did versus did not take a bite of the new food (e.g., greater use of physical prompts, commands); 2) Direct commands by the parent for the child to eat would relate to greater consumption of an unfamiliar food; 3) Physical prompts to eat (e.g., putting food on the child's fork) or direct feeding of the child would relate to increased consumption of unfamiliar foods; 4) Children being away from the table at mealtimes and playing with food or toys during mealtimes would relate to fewer child bites of the unfamiliar food. In addition to examination of these hypotheses, exploratory analyses were performed to identify any additional mealtime behaviors (e.g., parental coaxes, parent talk unrelated to food, child refusals, child requests for food) related to bites of the unfamiliar food.

Material and Methods

Participants

Families of children aged 2 through 8 years old and diagnosed with ASD were recruited through two Midwest hospitals in the United States. Children who were currently receiving services at the hospital, who had previously received an ASD assessment, or who had previously received medical or therapy services and completed a registry indicating interest in research were approached about the research study by a research or medical professional. Child ASD diagnosis was verified by research staff through review of the child's medical records or by parents providing a copy of the paperwork from the mental health professional who made the ASD diagnosis. However, information about ASD severity, verbal ability, and sensitivities was not obtained. Inclusion criteria also included the necessity that the child's family spoke English in the home because of measurement restrictions. Children were excluded if the child was dependent on a gastrostomy tube for his or her complete nutrition or the child was living in foster care (due to possible instability in their living situation and mealtimes).

Ninety-eight families were contacted about participation, and 46 families (46.94%) were enrolled. The most frequent reason families were not enrolled ($n = 27$) was that the family could not be reached or was initially presented information about the project but was not reached to follow-up on their interest in participating. Thirty-eight children and their families (82.61% of those enrolled) completed study measures and were included in study analyses. Six families (13.04%) withdrew from the study, noting family or child

emergencies/health concerns and the time demand of completing the study as reasons for withdrawal. One participant was excluded because of a protocol violation, and one participant was excluded because the child's mother rated the videotaped meal as not typical and declined to film another meal.

Procedures

The current project occurred as part of a larger project assessing mealtime behaviors and weight in children with ASD. Study procedures were approved by the Institutional Review Boards of all participating institutions. Families who wanted to participate provided verbal consent over the phone for a research assistant to come to their home and completed written informed consent during the first home visit. Also prior to the home visit, the parents identified an unfamiliar food for their child, which the researcher supplied and the parents presented during a videotaped meal. Because Schreck and Williams (2006) found that children with ASD consumed less than 50% of fruit, vegetable, protein, starch, and dairy food options, despite the fact that these foods were consumed by more than 50% of children's families, five food options were initially offered as unfamiliar foods (canned pears = fruit, canned green beans = vegetable, canned baked beans = protein, box of stovetop stuffing = starch, prepackaged light yogurt = dairy). No children were provided green beans or yogurt, because all participants had been previously presented this food. In addition, in 17 children (45%), alternative unfamiliar food options were needed because these children had previously been exposed to all of the standard foods. Alternative unfamiliar foods provided included: frozen broccoli, fresh spinach, frozen artichoke, fresh kale, fresh purple cauliflower, apple, fresh radishes, frozen okra, boxed chicken flavored pasta, fresh kiwi, and fresh asparagus. Alternative foods were suggested by parents when they were asked by the researcher to identify a food their child had not been previously been presented to eat. If parents were unable to provide a suggestion, the researcher proposed options for the family. The researcher typically started by providing options of foods that were either similar to the original list of unfamiliar foods (e.g., another common fruit, such as apples, bananas; another common starch, such as pasta or rice) or that other families had selected as an alternative unfamiliar food in past meals. An ANOVA was conducted to determine whether number of accepted bites varied between the standard and alternative foods. All standard foods presented (i.e., stuffing, baked beans, pears) were collapsed, and all alternative foods presented (e.g., spinach, radishes, broccoli) were collapsed, to create an independent variable with two categories. There was no difference in the number of bites taken by children presented one of the five standard foods versus a non-standard food, $F(1, 36) = 1.33, p = .26$. Multiple standard food options were used because each child's previous experience with food differs, making it unlikely that all children would be unfamiliar with one particular food.

Parents completed forms to record family demographics, mealtime behaviors, and their child's diet. However, only the demographics and mealtime rating forms were used in the present project. The researcher supplied video equipment for the family to use to record family mealtimes and demonstrated how to use the equipment. The researcher instructed families to record four family meals (either lunches or dinners) and the last meal was used in the current project to minimize any effect of reactivity to the camera on mealtime behaviors.

For the last meal, 28 dinners (73.68%) and 10 lunches (26.32%) were recorded. Whether number of bites of unfamiliar food differed between lunches and dinners was examined using a t-test accounting for unequal variances between groups, the Satterthwaite test. No significant difference was found, $t(11.09) = 1.25, p = .24$. For the last meal, the researcher asked parents to present the unfamiliar food to their child in the same way they might normally present an unfamiliar food, with the exception that the food could not be mixed with other foods to the extent that it could not be identified when the child was taking a bite of the unfamiliar food. No other instructions were provided to the parent about how to serve or present the food (e.g., whether to cut the food, serve it raw). Once parents completed the videotaping and other study measures, the researcher completed the second home visit to collect the study supplies and provide compensation.

Measures

Dyadic Interaction Nomenclature for Eating (DINE; Stark et al., 1995)—The *DINE* is a reliable and valid coding system of mealtime behaviors for children 2 – 8 years old. The system is used to code family mealtimes occurring in the child's home and has been used in several pediatric populations (e.g., cystic fibrosis, type 1 diabetes; Patton, Odar, Midyett, & Clements, 2014; Stark et al., 1995). The *DINE* includes three categories of behavior: Child Eating, Child Behavior, and Parent Behavior. Child Eating measures the frequency of bites and sips and the number of intervals that food is spit out. The amount of fluid or food consumed during bites and sips was not quantified, and the specific food was not recorded, unless this was the target unfamiliar food. Child Behavior measures the frequency of compliance or noncompliance to direct commands to eat by parents and the number of intervals containing refusal or complaints about food, child requests for food, child talk, the child being away from the table or food, and the child playing. Parent Behavior measures the frequency of direct commands to eat and interrupted commands to eat, and the number of intervals containing coaxes, reinforcement, parent talk, physical prompts, and parents feeding the child. Table 1 presents *DINE* operational definitions for behaviors coded. With the *DINE*, observers record behavior in consecutive 10-second time intervals throughout the meal.

Coders were graduate students in either clinical psychology or dietetics previously trained on the *DINE* to adequate reliability. Study meals were coded by one primary coder (the first author) with reliability coding completed by a secondary coder for a randomly selected 25% of the meals (i.e., 10 randomly selected meals). Kappa scores for reliability were .76 for child behaviors, .62 for parent behaviors, and .83 for child eating behaviors. All of these values were above the .60 Kappa coefficient value deemed as the minimum cutoff for adequate reliability and are consistent with other published studies using the *DINE* in pediatric psychology (Powers et al., 2005; Stark et al., 2005).

Mealtime Rating Forms—Parents rated the typicality of the videotaped meals on a scale of 1 (*Not Typical*) to 5 (*Very Typical*). Parents were asked to take into account all aspects of the child's behavior, the mealtime (e.g., family members present, structure of meal), and parents' behavior (with the exception of the unfamiliar food being provided). Only meals rated as a 3 or higher were included in analyses.

Demographics—Demographic data (e.g., child gender, information on socioeconomic status) were collected via parent-report to characterize the sample.

Diet Diaries—Parents recorded the child's entire food and beverage intake over a three-day period. Parents received training on recording foods and beverages at the initial home visit and were provided measuring cups and spoons and a food scale for measuring the amount of each food and beverage. Diaries were analyzed by counting the number of unique foods consumed over the three day period, as a measure of child food selectivity.

Brief ASD Mealtime Behavior Inventory (BAMBI; Lukens & Linscheid, 2008)—The *BAMBI* is a standardized and validated parent-report measure of child mealtime behaviors developed specifically for children with ASD. The inventory has 18-items that ask parents to rate on a Likert scale how frequently their child performs mealtime behaviors (e.g., cries or scream during mealtimes, turns away from food). Questionnaire items represent three larger factors: limited variety of foods, food refusal, and features of ASD.

Parent Mealtime Action Scale (PMAS; Hendy et al., 2009)—The *PMAS* is a measure of parent mealtime behaviors. The measure assesses the frequency at which parents display behaviors on the following dimensions: snack limits, positive persuasion, daily fruit/vegetable availability, use of rewards, insistence on eating, snack modeling, special meals, fat reduction, and many food choices.

Child Anthropometrics—Child anthropometrics were obtained at the first home visit using a portable stadiometer (Holtain, Crymych, United Kingdom) and portable SECA digital scale (SECA, Hamburg, Germany). Child height and weight were each measured three times and the median values were retained to calculate child Body Mass Index (BMI) and BMI percentile using the Baylor College of Medicine calculator (Available at <http://www.bcm.edu/cnrc/bodycomp/bmiz2.html>). This calculator uses Center for Disease Control growth charts to calculate BMI percentile (Available at <http://www.cdc.gov/growthcharts/>). Child BMI percentile was used to classify children as underweight (BMI < 5th percentile), healthy weight (BMI between 5th– 85th percentile), overweight (BMI between 85th– 95th percentile), and obese (BMI > 95th percentile).

Data Analyses

Logistic regressions examined whether the occurrence of parent and child behaviors throughout the meal predicted the dichotomous variable of whether the child tried or did not try a bite of the unfamiliar food. These analyses used a dichotomous outcome variable of “yes” or “no” the child tried a bite of the unfamiliar food at any point during the meal, so there were $n = 38$ observations. The independent variables in these analyses were the raw total occurrences for parent commands, parent coaxes, and sips, and the total number of intervals in which all other coded parent and mealtime behaviors occurred over the course of the meal (see *DINE* description for specifics of how each behavior was coded- i.e., either by frequency or by interval).

To identify parent and child mealtime behaviors followed by a child bite in the same or subsequent 10-second interval, we used multilevel logistic regressions because several

mealtime intervals (Level-1) were nested within each participant (Level-2). The total number of Level-1 units was the total number of 10-second intervals across all meals ($n = 3879$), and there were 38 Level-2 units (can be considered meals, children, or families). Analyses examined whether the occurrence of parent and child behaviors was related to the binary variable of the child taking or not taking a subsequent bite of the unfamiliar food in the same or following 10-second interval. Most mealtime behaviors were coded as 1 (occurrence) or 0 (nonoccurrence) for each 10-second interval. However, a small number of parent and child behaviors were recorded as frequency counts during each interval (i.e., parent alpha commands [those not followed by any additional parent communication for at least 5 seconds], parent beta commands [those interrupted by other parent verbalizations], feeds, child bites, child sips). Given the low variability in the frequency of occurrence of these variables (e.g., very few instances of occurrence > 1 occurred), these variables were dichotomized as occurrence versus nonoccurrence for data analyses. Multilevel analyses were completed using the “glmer” function in the R package *lme4* (Bates, Mächler, Bolker, & Walker, 2014) and the full-information maximum likelihood estimator (FIML), and single-level analyses were carried out using the “glm” function, available in the base distribution of R (version 3.0; R Core Team, 2014). Models were first specified using a random intercept and fixed slope, meaning the relationship between the mealtime behavior and bites of the unfamiliar food was not allowed to vary across participants. Next, the models were specified using a random slope, where the effect was allowed to vary across participants. Chi-square difference tests were calculated to examine whether the fixed- or random-slope model was more appropriate to describe the relationship between behavior and bites of the unfamiliar food.

Correlations were calculated between observed mealtime behaviors on the DINE, and parent-report of child and parent mealtime behaviors on the PMAS and BAMBI. The percentage of mealtime intervals in which each mealtime behavior was observed was used as the DINE outcome variable. Single item scores were used from the BAMBI and PMAS. Comparison of single items scores on parent-report measures to observed behaviors using the DINE has been modeled in prior research (Piazza-Waggoner, Driscoll, Kruglak Gilman, Powers, 2008).

Results

Participants were 27 (71.05%) boys and 11 (28.95%) girls ranging in age from 2 years 5 months to 8 years 10 months (M age = 5.80, $SD = 2.01$). Children were predominantly Caucasian ($n = 22$, 57.89%) and included families from a range of family annual incomes. The majority of children ($n = 36$, 94.74%) were currently or had previously received services to address symptoms and associated features of ASD (e.g., speech therapy [$n = 28$, 73.68%], occupational therapy [$n = 26$, 68.42%], behavioral therapy [$n = 19$, 50.00%]). Sixteen children (42.11%) were currently taking a psychotropic medication to manage behavior or ASD symptoms. Average number of foods consumed in a 3-day period by the child was 19.49 ($SD = 6.56$, range 10–38, median 19), which is an average of 6.50 foods a day for the sample. Approximately 1/3 of the children consumed on average less than 5 different foods each day, and only 2 children (5%) consumed on average 10 different foods each day. See Table 2 for complete participant demographics.

Videotaped meals lasted an average of 17.00 minutes ($SD = 9.62$, range: 1.00 minute to 39.67 minutes). One meal only lasted for 1 minute, because the child's parent chose to discontinue the meal when their child displayed significant food refusal. However, this meal was rated as typical by the child's parent, and therefore, it was still included in the analyses. On a scale from 1 (Not Typical) to 5 (Very Typical), the average rating for included meals was 4.24 ($SD = 0.71$).

Twenty-two children (57.89%) took a bite of the unfamiliar food. Children who took a bite of the unfamiliar food took an average of three bites ($SD = 5.11$, range: 1–21 bites). An ANOVA was conducted to identify whether the number of bites accepted varied based on the unfamiliar food presented. The independent variable was the specific unfamiliar food provided (e.g., pears, broccoli). There were a number of foods that only 1–2 children received, and these foods were collapsed into an "Other Foods" category. This analysis was completed to identify whether using multiple unfamiliar foods contributed additional variance to our primary outcome of bites accepted. The number of bites of the unfamiliar food did vary based on the type of food presented, $F(4, 33) = 3.03, p = .03$. However, this relationship was no longer significant when one outlier was removed: one child took 21 bites of the unfamiliar food (i.e., pears), which was the highest value, $F(4, 32) = 1.94, p = .13$. See Table 3 for the average number of bites by type of unfamiliar food.

Table 4 presents information on the occurrence of each parent and child mealtime behavior over the course of the meal. In the logistic regression analyses examining which behaviors throughout the meal predicted whether a child took a bite of the unfamiliar food, child sips during the meal was the only significant predictor, $z = -2.42, p = .02$. Children who took more sips were less likely to take a bite of the unfamiliar food.

Sequential analyses examined which parent and child mealtime behaviors were associated with increased likelihood of the child taking a bite of the unfamiliar food in the same or subsequent interval. Parent direct commands to eat were associated with subsequent bites of the unfamiliar food, $z = 2.01, p = .04$. The association between parent commands and bites of the target food was adequately modeled as a fixed effect and not better modeled as a random effect, $\chi^2(2) = 2.56, p = .28$, meaning the effect of parent commands does not vary across children. Parent feeds of the child were significantly related to greater likelihood of subsequent bites of the unfamiliar food, $z = 6.69, p < .001$. But the association between parent feeds and bites of the unfamiliar food was better represented as a random effect ($\chi^2(2) = 12.42, p < .01$), meaning that the effect of feeds on bites of the unfamiliar food was different across children. Contrary to the hypothesis, parents' use of physical prompts to eat was not associated with the child taking a bite of the unfamiliar food in the same or subsequent interval ($z = .56, p = .58$). Likewise, all other parent behaviors (i.e., beta commands, parent talk, coaxing, reinforcement) were not related to subsequent bites of the unfamiliar food.

Given that the effect of parent feeds was found to vary across children, possible interactions between child factors and the effect of feeds were examined. Specifically, the child's gender and age, whether the child currently took psychotropic medications, and whether the child was normal weight (BMI between the 5th and 85th percentile) compared to overweight/obese

(BMI over the 85th percentile) were entered into the model. A trend was found for psychotropic medications, $z = -1.81, p = .07$, suggesting the impact of feeds on child bites may have been different for children on psychotropic medications in comparison to children not on psychotropic medications. The interaction was probed by examining the effect of feeds separately for children taking and not taking medications to address behavioral or psychological symptoms. The model was run without containing other interaction terms because these were not found to be significant. Feeds were related to subsequent bites of the unfamiliar food for children on medication, $z = 3.15, p < .01$, but not for children who were not taking medication, $z = 1.36, p = .18$. Other interactions explored were not significant: child gender ($z = 0.64, p = .52$), child age ($z = -.018, p = .86$), weight status ($z = -.27, p = .78$).

Regarding child mealtime behaviors, the child being away from the table was associated with lower likelihood of taking a bite of the unfamiliar food in the same or subsequent interval, $z = -2.39, p = .02$. The effect of the child being away from the table was found to be consistent across children and was not better modeled as a random effect, $\chi^2(2) = 3.90, p = .14$. For all children, there were no bites of the unfamiliar food following child play, and a statistic for the association between child play and bites of the unfamiliar food could not be computed because there was no variability (i.e., the model would perfectly predict bites of the unfamiliar food). Child talk (not related to food requests or food refusals) was also associated with a lower chance of subsequent bites of the unfamiliar food, $z = -2.59, p < .01$, and the association was better modeled as a fixed effect versus a random effect, $\chi^2(2) = 0.13, p = .94$. However, for the remaining child behaviors (i.e., requests for food and food refusals), no associations were found with the number of bites eaten of the unfamiliar food in the same or subsequent interval.

Agreement between parent-report and observed mealtime behaviors was found for some behaviors. Specifically, observed child food refusals related to parent-report of how frequently their child turns his/her face or body away from food ($r = .45, p < .01$), and observed child spit-ups related to parent-report of how frequently their child expels food that he/she has eaten ($r = .34, p = .04$). However, agreement was not found between parent-report and observed mealtime behaviors for all behaviors. See Table 5 for all correlations between parent-report and observed behaviors.

Discussion

The current study examined parent and child mealtime behaviors related to consumption of an unfamiliar food by children with ASD. The study used a unique observational methodology to examine behaviors at a typical home meal. Children who took more sips of drink during the meal were less likely to take a bite of the unfamiliar food. Given that sips of drink and bites of food cannot occur simultaneously, greater sips may minimize the opportunities for bites of the unfamiliar food. Children may also take sips of drink to distract from parental demands to try a food or to avoid taking a bite of food. Further, it could be the case that children who take a large number of sips experience satiety from their drink consumption, and therefore, are less likely to try a bite of the unfamiliar food.

The fact that only one parent or child mealtime behavior (i.e., child sips of drink) differentiated between children who did or did not take a bite of the unfamiliar food suggests that additional factors about the meal, the child, and the parent may play a bigger role than mealtime behaviors in determining which children try unfamiliar foods at mealtimes. For example, child factors such as sensory sensitivity, motor impairments, language difficulties that impair ability to understand commands, and ASD severity may impact whether the child takes a bite of unfamiliar foods at mealtimes. Furthermore, there may be other aspects of family mealtimes not assessed by the current study that predict whether children with ASD try unfamiliar foods. For example, whether parents sit down with children at the meal, whether the unfamiliar food was given to all family members at the meal, whether the unfamiliar food was presented at the start or end of the meal, or the child's preference for other foods presented at the same meal may impact whether the child takes a bite of an unfamiliar food.

Parent commands to eat increased the likelihood of subsequent bites of the unfamiliar food by the child within a close temporal window (i.e., the same or subsequent time interval). This is consistent with prior research that has found parental prompts for eating are related to greater food consumption (McKenzie et al., 1991). Further, past research has identified that limited child diet variety is related to greater parental permissiveness and fewer attempts to increase consumption of food (Williams et al., 2008), which is the opposite of parental commands. Interestingly in the current study, commands were only effective for increasing bites of the unfamiliar food when the command was followed by an opportunity for the child to comply (i.e., take a bite of the food), and parent commands were not found to be effective when the command was followed shortly (i.e., within 5 seconds) by talk or additional commands by the parent. Further, parent coaxes (defined as offers of additional food, encouraging positive evaluations of food, vague commands, or making games out of eating) were not related to subsequent bites of the unfamiliar food. Direct commands to eat may be more effective for increasing child consumption of foods than other parent verbalizations meant to increase food consumption. Thus, in feeding interventions for children with ASD, parents might receive instruction on how to provide effective commands, be given the opportunity to practice this skill, and be discouraged from making attempts to coax their child to eat an unfamiliar food. Additionally, interventions could teach parents to wait and give their child an opportunity to comply with their commands to eat before providing additional commands or engaging in other verbal interactions with their child. Parents may also benefit from education on how to recognize child behaviors used to avoid or stall eating behaviors (e.g., talking or playing) and how to engage in parenting strategies to decrease the occurrence of these child behaviors.

Direct feeds of the child by the parent were also related to increased likelihood of subsequent bites of the unfamiliar food in the same or next 10-second interval, which is consistent with research in applied behavior analysis and the non-removal of the spoon strategy (Kerwin, 1999). Interestingly in the current study, this behavior occurred as a naturally employed technique by parents without the parents necessarily having prior education about the non-removal of the spoon technique. Parents in the current study did not follow the exact rules and procedure for the non-removal of the spoon technique, yet this strategy was still found to be effective, suggesting variations of the technique used in

applied behavior analysis may also be effective. Direct feeds of the child may be specifically effective in children with ASD because it may minimize any impairment caused by poor fine motor skills. Parental feeds of the child also require less response effort from the child than child independently feeding (viz., loading a fork with food and moving it to the mouth), and it may be by this mechanism that parent feeds are effective for increasing bites. In follow-up analyses, feeds were associated with subsequent bites of the unfamiliar food for children taking psychotropic medications to address behavioral or psychological symptoms, but not for children who were not on medications. It may be the case that children taking medication are more severely impaired, and therefore, the concrete prompt of parent feeds is more effective because it does not require verbal communication and requires less motor skills. Taking psychotropic medications may also be related to improved behaviors and compliance, which may in turn make these children more likely to comply with parent prompts to eat. However, it should be noted in this study that psychotropic medications included both medication that can decrease appetite (e.g., stimulant medications) and medications that can increase appetite and lead to weight gain (e.g., risperidone), potentially complicating the interpretation of these results. Therefore, future research should examine the influence of specific medications on bites of unfamiliar food in a larger sample.

Other physical prompts to eat, including putting the child's food on a fork or pointing to the child's food, were not associated with greater frequency of subsequent bites of the unfamiliar food. This suggests that simply reducing the motor skill demands required to eat was not sufficient to increase the likelihood of a child bite of the unfamiliar food. However, because verbal commands were found to increase the likelihood of subsequent bites across all children, it is likely that children, regardless of language abilities, may be able to understand verbal commands to eat, therefore making nonverbal physical prompts unnecessary. Parents seem able to adequately tailor command complexity and vocabulary to a level that their child can easily understand and could be encouraged to use verbal prompts to eat versus physical prompts.

Some child mealtime behaviors were also associated with subsequent bites of the unfamiliar food. For example, the child being away from the table, child talk, and child play at the dinner table were all related to fewer subsequent bites of the unfamiliar food. Past research has also supported an association between children playing with their food and feeding difficulties (Sanders et al., 1993). These behaviors may distract children from eating. Additionally, the occurrence of these child behaviors at mealtimes may signify less parental control and less structure at these meals, which may decrease the likelihood of the child trying an unfamiliar food or meeting parent demands at meals. Interventions targeting food selectivity in ASD could help parents to eliminate the time their child spends away from the table or playing with toys at mealtimes. The current study also suggests that if the goal of mealtimes is to introduce an unfamiliar food, allowing the child's conversation to focus on topics besides eating may decrease the likelihood of consumption of the unfamiliar food and should be discouraged.

Although some child mealtime behaviors were associated with likelihood of a subsequent bite of an unfamiliar food, child food refusal was not related to subsequent bites of the unfamiliar food. Children who express complaints about food or refuse to eat a food may

still eat a bite of the food in a subsequent interval. Therefore, parents will want to continue to present their child with non-preferred foods even if their child refuses the food. Additionally, parents may benefit from education on strategies to manage child refusals and resistance so that they may feel more confident in maintaining expectations to eat despite child refusals.

Interestingly, little agreement was found between parent-report of the frequency of parent and child mealtime behaviors and the frequency of such behaviors observed in the videotaped mealtimes. Prior research comparing mealtime behaviors observed using the DINE and parent-report of such behaviors has found greater agreement, with agreement between approximately half of the behaviors analyzed (Piazza-Waggoner et al., 2008). However, this study was completed with young children with cystic fibrosis, rather than children with ASD, and observed behaviors were compared to self-report on a different mealtime behaviors measure than the current study. Our current results suggest that parent perceptions of child and parent mealtime behaviors may not accurately capture the nature of home mealtimes for children with ASD and their families, underscoring the need for direct observation when assessing problematic mealtime behaviors and therapist-initiated goal setting, at least initially, to focus feeding therapy treatment goals. However, the possible limitation of bias introduced by the mealtime coders in their perceptions of mealtime behaviors should also be considered. Further, although parents rated all included meals as typical, it is still possible that some behaviors were altered due to the presence of the video camera.

The current study examined parent behaviors that can be used during typical family meals without requiring intensive training. These are mealtime behaviors that may already be a part of parents' behavior repertoire and associated with increased consumption of unfamiliar foods. Behavioral parent training groups have led to changes in mealtime behaviors in children with chronic conditions and their families (e.g., Patton et al., 2014). Because the association between most parent and child mealtime behaviors and subsequent bites of an unfamiliar food did not differ across children, group treatment programs may be both effective for families of children with ASD and more cost-effective than an individual treatment program. Also, these interventions can often be conducted with only parental involvement, eliminating the burden of involving the child with ASD directly in the intervention group. This characteristic of parent training groups may be particularly helpful among children with ASD who may have difficulty attending treatment groups due to their social skills deficits. However, given the multifactorial nature of feeding difficulties, a multidisciplinary team approach to treatment of food selectivity may be required for a subset of children with more complex feeding problem presentations.

The current study did not examine the severity of children's ASD symptoms, which may be a factor that influences children's willingness to try the unfamiliar food. Because mealtime behaviors did not differentiate children who tried a bite of the unfamiliar food from those who did not, severity of ASD symptoms could have explained some of this variance. However, if it is possible that medication use could serve as a proxy measure for ASD severity, then this might suggest that ASD symptom severity could impact parent mealtime behaviors as well as a child's willingness to take a bite of an unfamiliar food. Future

research should measure symptom severity to determine its association with mealtime behaviors and children's willingness to try the unfamiliar food. Additionally, future research should examine the influence of other cognitive, physical, and developmental factors, such as sensory sensitivity and on food refusal.

The current study was also not able to provide information about potential differences in the mealtime behaviors of children with ASD in comparison to typically developing children or children with other developmental disabilities, given no control groups were utilized. However, a significant body of past research has previously examined differences in mealtime behaviors between typically developing children and children with ASD and found a number of mealtime behavior differences (Nadon, Ehrmann Feldman, Dunn, & Gisell, 2011; Provost et al., 2010; Schreck et al., 2004). Therefore, the current study did not attempt to examine this hypothesis.

The lack of a study-obtained ASD diagnosis is a limitation of the current study. As mentioned earlier, children's ASD diagnoses were verified using medical record data or other documentation. These were clinical diagnoses and it is likely that clinicians from different centers may not have used the same assessment procedure when making the ASD diagnosis. This could introduce some bias in the sample, which could affect generalizability of the results. Additionally, the presence of the camera at home mealtimes and lack of deception (families knew they were being videotaped) may have caused parents and children to modify their mealtime behaviors. However, design steps were taken to address this limitation, including using the last of four videotaped meals for the analyses to give families the opportunity to adapt to the camera. The fact that parents tended to rate these videotaped meals as typical for their child, despite the camera and the introduction of the unfamiliar food, suggests that families' mealtime behaviors may not have been affected by the camera. Additionally, all study participants were not presented the same unfamiliar food. While it is possible characteristics of the food itself or its presentation may have influenced children's acceptance of the food, the current study found that bites taken did not vary across the different unfamiliar foods used (after removing an outlier value). Given our focus was not on which food was more accepted, it is felt that our conclusions are still appropriate despite differences in the food, because all children were presented with a food for the first time. However, it is important to note that the analyses examining differences in bites accepted by type of food is only intended to be descriptive for the current study and is not generalizable. Despite these limitations, the current study is novel in that it examines behaviors at typical home mealtimes using an observational methodology.

Future research should continue to examine food selectivity at home mealtimes in children with ASD, including mealtime correlates and intervention strategies. Given that the association between child sips and whether or not children took a bite of the unfamiliar food, future research should examine the types of drinks provided at home mealtimes and whether the type of drink provided relates to bites taken of unfamiliar foods. The presentation of certain types of drinks (e.g., high caloric drinks) during mealtimes may hinder children from trying unfamiliar foods. Additionally, given that sips was the only mealtime behavior that differentiated between children who took a bite of the unfamiliar food from those who did not, future research should examine other child, parent, or mealtime factors that may be

related to child food selectivity. For example, past research has found a relationship between sensory sensitivity and food selectivity (e.g., Cermak et al., 2010). Examining how sensory sensitivities interact with eating behaviors and how parents can appropriately respond to sensory sensitivities would provide additional information to inform behavioral interventions targeting food selectivity.

Conclusions

Clinical interventions for treating food selectivity in children with ASD are critical, and a number of interventions have been developed to date (Matson & Fodstad, 2009). Our current findings suggest clinical interventions for food selectivity in children with ASD might provide parents education on effective mealtime parenting strategies (e.g., commands and feeds) to accompany their already existing strategies for encouraging appropriate child mealtime behaviors (e.g., not playing at the table, not being away from the meal). Specifically, interventionists should teach parents strategies to reinforce appropriate child mealtime behaviors. Positive reinforcement and contingency management would be avenues by which parents can encourage behaviors that are incompatible with the child mealtime behaviors associated with less bites of an unfamiliar food in the current study (i.e., playing at meals, talking unrelated to food). For examples, rewards could be provided for children placing toys in an area away from the dinner table or meal space. Additionally, parents should be provided education on the effectiveness of commands and feeding the child for increasing bites of unfamiliar food, including modeling of appropriate commands and feeds by the interventionist and opportunities for the parents to practice these skills. Live feedback from the interventionist through “bug in the ear” technology during a parent-child feeding interaction may also be helpful. Future research should develop and examine the effectiveness of interventions tailored to the needs of families of children with ASD, including the effectiveness of interventions for modifying mealtime behaviors in this population. Findings of the current study suggest that parent and child mealtime behaviors represent modifiable factors that relate to consumption of unfamiliar foods by children with ASD.

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- Behaviors related to bites of unfamiliar food by children with ASD were explored
- Parent direct commands and feeds of the child related to more subsequent bites
- Children playing and being away from the table related to fewer subsequent bites

Table 1**Abbreviated DINE Operational Definitions**

Parent Behaviors	
Commands (Alpha)	Parent verbalizations specific to eating to which a motoric response is appropriate and feasible. Commands may be in the form of an order, question, rule, or contingency. e.g., "Eat your peas."; "You should eat now."; "If you eat your potatoes, you can have dessert"
Beta Commands	Commands that would have been Commands (Alpha), but there was no opportunity to comply because 1) the command was followed within 5 seconds by a parental verbalization or 2) the parent restricted the child's mobility or removed food/drink
Coaxing	A verbalization about food or eating that does not qualify as a command but has the goal of increasing the child's consumption. This includes offers of food, encouraging positive evaluation of food, making eating a game, or commands so vague that it is unclear eating is the behavior to be initiated. e.g., "Come on."; "Isn't this hamburger good?"
Reinforcement	Positive verbal or physical behavior by the parent that is directed to the child after he/she eats or drinks. Reinforcement can be either verbal or physical. e.g., "Good job."; clapping
Parent Talk	Verbalizations not referring to food or eating
Physical Prompt	A physical action by the parent to indicate to the child to eat or drink. e.g., pushing the child's plate closer to the child; pointing to the child's food; scraping child's food into a pile
Eating Behaviors	
Bite	Any taking of solid food through the mouth and passing between the child's lips.
Sip	Bringing a glass, cup, straw, or spoonful of liquid to the lips.
Spit-up	Any time the child spits-ups, spits out, or purposely drops food from his/her mouth.
Feed	Parent attempts to put food in the child's mouth with no attempt to have the child help.
Plate Away	Any time someone moves the child's plate out of his/her reach.
Child Behaviors	
Food Refusal	When the child lets the parent know that he/she does not want more food or complains about the taste of food. Refusals can be verbal or non-verbal. e.g., "Take it away."; "Yuck!"; turning head away from a feed, gesturing for food to be removed
Requests for Food	Any verbal or nonverbal child initiated behavior in which the child asks for additional food e.g., direct verbalizations/requests for food ("Can I have a cookie?"); pointing to food
Child Talk	For non-verbal children: any vocalization, including nonsense syllables For verbal children: recognizable conversation or words
Play	Play with toys or use of food-related materials as play objects e.g., playing with a doll or car; moving a fork through the air and pretending it is an airplane
Away	Any time the child is more than an arm's length from their food, puts their head below the table, or turns their back to the food

Table 2**Participant Characteristics**

	n (%)
Gender	
Male	27 (71.05%)
Female	11 (28.95%)
Ethnicity	
Caucasian	22 (57.89%)
African-American	7 (18.42%)
Biracial	7 (18.42%)
Hispanic	2 (5.26%)
Family Annual Income	
\$0– \$19,999	8 (21.05%)
\$20,000– \$39,999	5 (13.16%)
\$40,000– \$59,999	5 (13.16%)
\$60,000– \$79,999	7 (18.42%)
\$80,000– \$99,999	2 (5.26%)
\$100,000 +	10 (26.32%)
No Response	1 (2.63%)
Medications Currently Taken to Manage Behavior or ASD Symptoms	
Stimulants	7 (18.42%)
Guanfacine	5 (13.16%)
Fluoxetine	5 (13.16%)
Risperidone	2 (5.26%)
Other	4 (10.53%)
Weight Status	
Underweight	None
Healthy Weight	26 (68.42%)
Overweight	5 (13.16%)
Obese	7 (18.42%)
Services Received	
Speech	28 (74%)
Occupational Therapy	26 (68%)
Applied Behavior Analysis/Other Behavior Therapy	19 (50%)
Physical Therapy	4 (11%)
Feeding Therapy	2 (5%)
Unspecified Services/Other	13 (34%)
Speech	28 (74%)
Occupational Therapy	26 (68%)
mean (SD), range	
Age	5.80 (2.01), 2.43 to 8.85

Table 3

Number of Bites Taken of Each Unfamiliar Food

Unfamiliar Food	Mean Number of Bites Per Meal (<i>SD</i>)
Pears (<i>n</i> = 8)	7.88 (8.94)
Stuffing (<i>n</i> = 8)	2.25 (3.33)
Broccoli (<i>n</i> = 4)	1.50 (1.29)
Baked Beans (<i>n</i> = 5)	0.00 (0.00)
Other Foods* (<i>n</i> = 13)	2.07 (2.33)

n = number of participants who were presented that unfamiliar food

* Examples of “Other Foods” include spinach, broccoli, radishes, pasta, applesauce

Table 4

Percentage of Intervals in which Child and Parent Behaviors Occurred

<u>Percentage of Intervals</u>	
Eating Behaviors	
Bites of Non-Target Food	32.46
Sips	4.05
Bites of Unfamiliar/Target Food	2.71
Feeds	1.70
No Plate	1.26
Spit-Ups	0.70
Child Behaviors	
Child Talk	34.93
Child Away	11.50
Refusal	7.12
Play	5.54
Request for Food	1.75
Cry (Unrelated to Food Refusal)	0.23
Parent Behaviors	
Parent Talk	33.13
Beta Commands *	5.85
Coax	4.80
Command	4.31
Physical Prompt	3.84
Reinforcement	1.47

* Beta commands are defined as parent commands to eat that are followed by parent talk, a parent coax, or an additional parent command before the child has an opportunity to comply (i.e., within 5 seconds).

Table 5Correlation Between Parent-Report⁺ and Direct Observation of Behaviors

Direct Observation Items (DINE)		Parent-Report Items	r	p-value
Child Food Refusals	Child turns his/her face or body away from food (BAMBI)	Child turns his/her face or body away from food (BAMBI)	.45	< .01 [*]
		Child closes his/her mouth tightly when food is presented (BAMBI)	– .12	.47
		Child dislikes certain foods and won't eat them (BAMBI)	.16	.33
Child Away	Child remains seated at the table until the meal is finished (BAMBI)	Child remains seated at the table until the meal is finished (BAMBI)	–.12	.47
Child Spit-Ups	Child expels (spits out) food that he/she has eaten (BAMBI)	Child expels (spits out) food that he/she has eaten (BAMBI)	.34	.04 [*]
Child Bites of the Unfamiliar Food	Child is willing to try new foods (BAMBI)	Child is willing to try new foods (BAMBI)	.03	.88
		Child accepts or prefers a variety of foods (BAMBI)	.14	.42
		Child prefers the same foods at each meal (BAMBI)	–.27	.11
		Parent provides special meals for child (PMAS)	–.09	.60
Parent Coaxes Child to Eat	Parent use of positive persuasion for child to eat (PMAS)	Parent use of positive persuasion for child to eat (PMAS)	.06	.73
Parent Reinforces Child Eating	Parent use of rewards to encourage child eating (PMAS)	Parent use of rewards to encourage child eating (PMAS)	–.05	.78

^{*} Significant at p-value < .05

⁺ Parent-report of mealtime behaviors is drawn from individual-item scores