Food preferences and factors influencing food selectivity for children with autism spectrum disorders

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Abstract

Although clinicians and parents widely accept that children with autism spectrum disorder exhibit more feeding problems than their typically developing peers, little information is available concerning the characteristic food items accepted by these children or the possible factors contributing to these feeding problems. This article used an informant-based questionnaire to survey parents of children with autism spectrum disorders (N = 138) to determine: (a) the types of feeding problems their children typically exhibit, (b) the food items their children prefer, (c) the relationship of feeding problems to family eating preferences, and (d) the relationship of the diagnostic characteristics of autism to feeding behavior. Results indicated that the children preferred fewer types of food items within groups than their families; however, family food preferences appeared to influence food selection more than the diagnostic characteristics of autism.

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Parents of children with autism spectrum disorders continually have reported difficulties in getting their children to eat. Most clinicians and diagnostic manuals (American Psychiatric Association, 1994) have agreed with parents that feeding issues have been a
significant problem for these children. Parents and clinicians anecdotally have described texture and taste preferences (e.g. eating only crunchy or salty food items) and presentation or idiosyncratic behavior (i.e. only drinking from baby bottles or sippy cups). Unfortunately, the specific eating problems for these children have not been widely described in empirically supported research literature.

The few available research articles on this topic have supported the anecdotal reports of parents, indicating selective eating based on food presentation and on food types (Ahearn, Castine, Nault, & Green, 2001; Archer & Szatmari, 1991; DeMyer, Ward, & Lintzenich, 1968; Kanner, 1943; Kinnel, 1983; Lopreiato & Wulfsberg, 1992; Minshew & Payton, 1988; Raiten & Massaro, 1986; Stone, MacLean, & Hogan, 1995; Teplin, 1999). Only one study has directly compared the eating habits and food preferences of children with autism spectrum disorders to typically developing children (Schreck, Williams, & Smith, 2004). Schreck et al. (2004) supported the previous research that children with autism have more feeding problems, including food refusal, idiosyncratic meal time behavior, and acceptance of a limited variety and texture of food items than typically developing children.

Although, these previous studies have provided preliminary information concerning the food selectivity of children with autism, little information continues to be available about the types of food items typically preferred within this population, the influence of family eating behavior on children’s food selectivity, and the relationship of food selectivity to the diagnostic characteristics of autism. The goal of this study was to expand on the information provided by previous research by: (a) identifying the number and types of food within each food group that children with autism spectrum disorders prefer, (b) describing the differences between what these children and their families prefer to eat, (c) predicting the numbers of food items children with autism spectrum disorders prefer to eat by family food preferences, and (d) predicting the number of food items preferred by the children by the severity of the children’s autism symptoms.

1. Method

1.1. Participants

Data were accessed from a database established for previous research on types of feeding problems for children with autism (Schreck et al., 2004). Responses were collected from parents or caregivers of children with autism spectrum disorders (N = 175). Children’s caregivers were recruited through membership lists for local, state, and national autism societies, schools for children with autism, and from a local doctor’s patient list of children diagnosed with autism.

Recruitment of participants was designed to produce a representative sample of children with autism. A combination of caregiver report of a professional diagnosis of autism and a Gilliam Autism Rating Scale (GARS, Gilliam, 1995) score ≥80 determined inclusion in the study. The GARS cut-off score falls within the range of “below average probability of autism”, the GARS manual indicates that 90% of children with autism fall within scores of 80 and above (Gilliam, 1995). Using this cutoff criterion, 37 participants were excluded from the study. Although that eliminated some children who reportedly were on the autism
spectrum, we felt that the combination of parental report and GARS scores provided a reliable diagnosis criterion. See Table 1 for participants’ GARS scores.

Demographic information was collected for all remaining children \((N = 138)\) and included: (a) date of birth, (b) age \((M = 8.3\text{ years}, \text{S.D.} = 2\text{ years }5\text{ months}, \text{range} = 4\text{ years }5\text{ months to }12\text{ years }8\text{ months})\), (c) height \((M = 51.36\text{ in.}, \text{S.D.} = 9.53, \text{range} = 33–122\text{ in.})\), (d) weight \((M = 66.06\text{ pounds}, \text{S.D.} = 26.92; \text{range} = 33–190\text{ pounds})\), (e) gender (male = 88\%, female = 10\%, unreported = 2\%), (d) presence of developmental disabilities, and (e) presence of medical problems. The established age range was chosen to avoid developmental times of transitions in eating behavior, such as transitioning from formula to solid food and typical toddler behavior.

The following developmental disabilities or mental health diagnoses were reported: autism \((n = 100)\), pervasive developmental disorder—not otherwise specified \((n = 47)\), Asperger’s disorder \((n = 29)\), attention deficit and hyperactivity disorder (ADHD) \((n = 19)\), learning disabilities \((n = 14)\), obsessive compulsive disorder \((n = 21)\), anxiety \((n = 14)\), seizure disorder \((n = 7)\), hearing impairment \((n = 1)\), visual impairment \((n = 2)\), depression \((n = 2)\), bipolar disorder \((n = 4)\), fragile X \((n = 2)\), and Down syndrome \((n = 1)\). Medical diagnoses included failure to thrive \((n = 0)\), seizure disorder \((n = 7)\), cardiac problems \((n = 3)\), seasonal allergies \((n = 17)\), lactose intolerance \((n = 8)\), pulmonary problems \((n = 3)\), gastro-esophageal reflux \((n = 5)\), constipation \((n = 11)\), diarrhea \((n = 6)\), liver problems \((n = 2)\), g-tube feedings \((n = 2)\).

1.2. Materials

The Personal History Form was used to gather demographic information (date of birth, weight, height, gender). The form required caregivers to indicate if their child was currently or previously diagnosed with any of a number of medical, developmental, or mental health diagnoses typically related in the literature to pediatric feeding problems.

The Children’s Eating Behavior Inventory (CEBI, Archer, Rosenbaum, & Streiner, 1991) is a caregiver report for evaluating mealtime behaviors, eating behaviors, and the disruption of feeding problems on family dynamics. This scale uses a five-point rating scale \((1 = \text{never to } 5 = \text{always})\) to measure the frequency of 19 different eating behaviors.

Table 1
Descriptive statistics for the GARS

<table>
<thead>
<tr>
<th>Domain</th>
<th>Range of scores</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autism quotient</td>
<td>80–137</td>
<td>94.96</td>
<td>10.42</td>
</tr>
<tr>
<td>Communication</td>
<td>4–17</td>
<td>9.69</td>
<td>2.39</td>
</tr>
<tr>
<td>Social</td>
<td>4–17</td>
<td>8.90</td>
<td>2.48</td>
</tr>
<tr>
<td>Stereotypy</td>
<td>4–15</td>
<td>9.50</td>
<td>2.19</td>
</tr>
<tr>
<td>Developmental</td>
<td>4–19</td>
<td>9.27</td>
<td>2.33</td>
</tr>
</tbody>
</table>

1 The numbers of medical problems, developmental disabilities, and mental health diagnoses should not be summed to determine an overall number of children with problems as the diagnoses are not discrete. For example, one child was reportedly diagnosed with over seven different conditions, thus, summing the numbers of the diagnoses would artificially elevate the total number of children with medical problems in this sample.
For each item, the rater also reports whether the behavior constitutes a problem (Yes/No). Items refer to behaviors, such as vomiting and self-feeding. Reliability for the total eating problem score is in the acceptable range ($r = 0.87$), as is construct validity (see Archer et al., 1991). This instrument is currently the only measure of eating and mealtime behaviors in children, and has been used successfully with children with autism (Archer & Szatmari, 1991).

The *food preference inventory* (FPI) is a caregiver report checklist of preferred or typically accepted food items from each of the five food groups (fruits, vegetables, dairy, proteins, carbohydrates, and miscellaneous mixed food items (e.g. stew)). Food items include a list of 27 fruits, six beverages/juices (since in our clinical practice, children with autism tend to accept juice more readily than fruits, we decided to separate the fruit food group into fruits and juices), 26 vegetables, 29 proteins, 37 carbohydrates, 14 dairy, and five miscellaneous mixed food items. Caregivers check food items if their child will eat an age-appropriate portion of the served food. Food items that are not eaten remain unendorsed. Caregivers also report whether food items are typically served to the entire family at meal times. Scores for the five food groups are obtained by summing the food items accepted by children within each food group (e.g. total number of vegetables typically accepted). Scores are also summed to obtain types of food items typically eaten by other family members (e.g. total number of vegetables typically eaten). The FPI was created by staff at an intensive behavioral feeding program for pediatric feeding problems to assist with intake information concerning family and children’s food intake.

The *Gilliam Autism Rating Scale* (Gilliam, 1995) is a professional and parent report scale for evaluating behaviors diagnostic of autism. The scale’s contents was derived from the criteria in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV, American Psychiatric Association, 1994) and from the Autism Society of America’s, (1994) definition of autism. Gilliam (1995) reported the scale’s uses as: (a) assisting with identification of autism, (b) identifying and targeting serious behavior problems, (c) evaluating progress for educational goals, and (d) providing a research measurement for autism. The Autism Quotient was normed on a sample of children ($N = 1.092$) with autism. The four domains (stereotyped behavior, communication, social interaction, and developmental disturbances) together yield an autism quotient to determine probability and severity of autism ($M = 100$, S.D. = 15), with 90% of the scores for children with diagnosed autism typically being $\geq 80$. The test manual (Gilliam, 1995) reported adequate validity and reliability for test domains and for the Autism Quotient (AQ).

### 1.3. Procedures

Data were analyzed from the database compiled for Schreck et al. (2004). Permission to conduct the study was initially obtained from the Penn State Office of Regulatory Compliance and the Penn State College of Medicine. Permission to access possible participants was initially obtained from the autism societies, schools for children with autism and the doctor’s office. Packets were distributed through the mail, by hand delivery, or by fax. All but the faxed packets contained return postage. Returned packets contained no identifying information. Since schools and parents were given permission to make
additional copies of the packet for distribution, we were not able to determine the total number of packets distributed. Consequently, a reliable return rate could not be calculated.

1.4. Data analysis

Parents’ responses on the CEBI were evaluated to determine the types of feeding difficulties for the children with autism. Since the majority of the children were reported to have some level of food selectivity, a description of the types of food items eaten by the children was obtained by examining parent responses on the FPI. The percentage of children reportedly eating fewer than one half of the listed food items within each food group (fruit, fruit juice, dairy, carbohydrate, protein, vegetable, miscellaneous mixed food items) was calculated.

Because the more than one half of the children ate fewer than half of the available food items within each food group, we decided to analyze the FPI scores for the eating patterns of the families. We did this to determine if the families were selective in their eating patterns, thus, providing limited opportunities for their children to choose a wide variety of food items within each food group. Additional analyses of the FPI were conducted to provide a comparative profile of each of the listed food items within each food group that were eaten by 50% or more of the children and their families.

The relationships of the child’s food preference to autism symptom severity and family eating behaviors were assessed by multiple regression analyses with the child’s food preferences as a criterion variable and the child’s GARS AQ and the percentage of food items the parents reportedly ate as the predictor variables.

2. Results

2.1. Types of feeding problems

Parents’ responses on the CEBI indicated that the children ate only a small variety of presented food items. According to parent reports on the CEBI, this restricted variety of accepted food items was not related to the food texture. In fact, parents stated that restricted food acceptances and refusal of most food items occurred for 72% (restricted variety) and 57% (refusal) for their children. Refusals were primarily related to food presentation (48.6%), such as using particular utensils or different food items touching on a plate. Other factors related to food refusal and acceptance included: (a) specific utensil requirements (13.8%), (b) food texture (6.5%), and (c) oral motor problems (23.2%).

2.2. Preferred food items

Within most food groups, the children ate fewer than half of the listed food items. For all of the food groups that included more than 10 listed food items except carbohydrates, the children, on average, ate fewer than 10 of the listed food items ($M_{fruits} = 5.86, M_{dairy} = 4.32, M_{vegetables} = 4.00, M_{proteins} = 7.82, M_{carbohydrates} = 14.67$). However, the majority of the families typically ate more than half of the listed food items within most
of the food groups. For all of the food groups that included more than 10 listed food items except dairy, the families, on average, ate more than 10 listed food items ($M_{fruits} = 12.41$, $M_{dairy} = 7.13$, $M_{vegetables} = 13.62$, $M_{proteins} = 15.86$, $M_{carbohydrates} = 22.88$).

Table 2 provides a comparison of the percentage of food items within each food group eaten by the children and their families. The descriptive statistics for the food preferences within each food group category for the children and families can be seen in Table 2. The comparison of the specific food items within each food group eaten by 50% or more of the children and/or their families can be found in Table 3. A visual analysis of these food items indicates that the children’s families consistently prefer a wider variety of food items than their children.

2.3. Relationship of child’s eating behavior to the diagnostic characteristics of autism or to family eating behavior

Because the preferred food items of the children appeared to be considerably fewer than their families for each food group, we decided to conduct further analyses to determine if the children’s eating behavior was related to the severity of the diagnostic symptoms of autism or if the children’s eating behavior was related to the family’s food preferences. (Descriptive statistics for the children’s GARS scores can be found in Table 1. Table 2 contains the descriptive statistics for the food preferences of children and families). To
Table 3
Foods eaten by more than 50% of children with autism and their families

<table>
<thead>
<tr>
<th>Food group</th>
<th>Children with autism</th>
<th>Family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>Apples (60%), grapes (52%)</td>
<td>Apple (65%), apple sauce (61%), bananas (70%), cantaloupe (64%), grapes (67%), oranges (63%), peaches (59%), pear (59%), pineapple (50%), strawberry (67%), raisin (53%), watermelon (69%)</td>
</tr>
<tr>
<td>Juices</td>
<td>Apple juice (63%), grape juice (54%)</td>
<td>Apple juice (50%), Lemonade (59%), Orange juice (75%)</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Asparagus (51%), broccoli (75%), carrot (80%), cauliflower (56%), celery (57%), corn (81%), cucumber (60%), greens (56%), green beans (76%), lettuce (80%), onion (63%), peas (68%), peppers (56%), pickles (67%), sweet potatoes (53%), tomato (74%)</td>
<td></td>
</tr>
<tr>
<td>Proteins</td>
<td>Baked chicken (50%), chicken nuggets (67%), hot dogs (65%), peanut butter (55%)</td>
<td>Baked chicken nuggets (74%), chicken (82%), hot dog (83%), peanut butter (73%), eggs (83%), fish sticks (63%), fried chicken (67%), fried/baked fish (59%), ham (73%), hamburger (80%), baked beans (65%), lunchmeat (73%), meatloaf (59%), bacon (78%), peanuts (55%), pork (71%), roast beef (74%), shrimp (64%), steak (74%), tuna salad (63%)</td>
</tr>
<tr>
<td>Starches</td>
<td>Cake (60%), cookies (77%), crackers (66%), French fries (70%), macaroni (51%), pizza (72%), potato chips (82%), pretzels (67%), spaghetti (65%), white bread (57%)</td>
<td>Cake (75%), cookies (77%), crackers (77%), French fries (75%), macaroni (80%), pizza (86%), potato chips (80%), pretzels (75%), spaghetti (83%), white bread (67%), bagels (70%), baked potato (80%), brown rice (56%), cornbread (51%), corn chips (60%), donuts (68%), egg noodles (63%), french toast (73%), lasagna (75%), mashed potatoes (80%), muffins (67%), oatmeal (57%), pie (64%), ravioli (62%), rolls (71%), tacos (65%), toast (73%), wheat bread (67%), white rice (71%), stuffing (70%)</td>
</tr>
<tr>
<td>Dairy</td>
<td>Ice cream (66%)</td>
<td>American cheese (73%), other cheeses (61%), chocolate milk (51%), hot chocolate (53%), ice cream (76%), milk (70%), pudding (57%), yogurt (62%)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
<td>Chili (62%), pot pie (53%), soup (75%), stew (65%)</td>
</tr>
</tbody>
</table>

determine if diagnostic severity or family food preferences were most important in predicting child food preferences, multiple regression analyses were performed entering the percentage of food items preferred by the child (done for the total number of food items and for each food group) as a criterion variable and the GARS Autism Quotient and percentage of family preferred food items (done for the total number of food items and for each food group) as predictor variables. For all types of food items, family food preference was the only significant predictor of the child’s food preferences (see Table 4). This relationship indicated that families who ate more restrictive diets had children with more...
restrictive eating behavior. Since the GARS overall AQ was not found to be statistically significant, additional analyses were not conducted on the individual GARS domains.

3. Discussion

This study found that children with autism were indeed idiosyncratically selective in the type of food items they accepted. In addition, it was found that food selectivity of children with autism was related to their family’s reported eating preferences. Specifically, the fewer food items the family reportedly ate—the fewer food items the child ate. However, given that relatively little variance that was explained in the regression analyses, we must assume that many other variables were involved in determining food preferences in children with autism spectrum disorders. Furthermore, this study did not find any evidence in support of commonly held assumptions that the feeding selectivity of children with autism could be related to their autism symptoms, such as problems in changing routines or sensory difficulties with textures.

Subsequent studies on family eating patterns and relationships to children with autism’s eating should address some of the limitations of this study. For example, the recruitment
method in this study may have produced a sample of parents with more concerns for their child’s food selectivity. Future studies could attempt to differentiate between clinical samples with parents who have feeding related concerns and non-clinical samples of children with autism spectrum disorders. The differentiation of children with autism, children with pervasive developmental disorder, and children with differing severities of mental retardation could also provide more information on the idiosyncratic eating behavior of these children. Additionally, by collecting more data on the family’s actual eating behavior, future studies could determine actual or typical food items eaten by families and their children during a week, rather than food preferences reported by the parents. By collecting actual intake data, the self-report biases that could have influenced the results of this study would be partially diminished. Parental attitudes and behaviors concerning feeding also could be assessed, such as discipline at meal times, parental expectations, parental modeling, etc. For example, it would be important to explore whether parents of children with autism model restrictive eating patterns (e.g. not trying new food items, making faces at new food items, continually presenting the same meal choices, etc.), or whether they allow the avoidance of novel food items.

In an attempt to further explain the influences on children with autism’s eating behavior, variables related to the child also should be addressed in future research. In this study, when the typical food menus were examined according to food group, food items preferred by 50% or more of the children with autism were very rare. The actual food items included foods that are high in sugar content, such as cakes, cookies, grapes, pizza, white bread, ice cream, etc. These food items tend to be sweeter tasting, which human infants innately prefer, while rejecting sour and bitter tastes (see Birch, 1987). These food items also tend to be on the medium to high end for the glycemic index (Foster-Powell, Holt, & Brand-Miller, 2002), which measures how quickly digestion of a carbohydrate triggers a peak in blood sugar (Nantel, 2003). Although, medical doctors use the glycemic index as a method of carbohydrate control for people with diabetes, the results of this study may indicate that children with autism consume food items that result in quick “sugar highs”. It may be interesting to examine this possibility in future research. While examining this, researchers may want to examine if food consumption and quick blood sugar changes result in any immediate behavior changes that could not be detected with the measures used to determine behavior in this study.

The intake of sweet tasting food items, such as the cakes, cookies, etc., eaten by children with autism could be explained by the theory that children have a predisposition for sweet and salty foods, while rejecting bitter or sour foods (Birch, 1999). Further, children tend to reject novel foods and learn preferences for familiar foods (Birch, 1999). Children with autism could have initially rejected novel food items due to the preference for routine commonly found for children with autism. However, children with autism may have habituated to the sweet tastes of food items. As they continually eat sweet tasting food items, they may be less likely to experience the sweet taste, thus, resulting in a craving for more of these food items to experience the sweet taste.

While the child may have habituated to sweet tastes, and thus require more of these food items, the child also may be sensitized to other tastes (e.g. bitter, sour, etc.). This sensitivity could be related to a physiological component—children with autism could be “Supertasters” (Bartoshuk, 2000). Bartoshuk (2000) contends that the biological
composition of the tongue may result in an extreme sensitivity to bitter tastes for some people. If children with autism have a propensity to experience bitter tastes more intensely, they may be physiologically punished for attempting to eat these foods. This sensitivity may result in the refusal of and conditioned aversion to many foods, as the intense taste of these foods may be aversive. Further studies should also address the relationships between the physiological components of food intake (i.e. glycemic index, taste habituation, etc.) and food preferences and refusals of children with autism, as the results may have implications for clinical intervention choices (e.g. systematic desensitization).

In addition to examining the physiological-behavioral interactions of feeding for children with autism, the relationship between autism characteristics and feeding behavior should receive further scrutiny. Although, this study failed to show a relationship between food selectivity and the severity of autism characteristics, it is important to determine if the restrictive eating of children with autism spectrum disorders influenced their families to restrict their eating behavior as well (e.g. not wanting to prepare a wide variety of food items for different family members), or if the family’s initial restricted food choices, consequent modeling selective food choices, and lack of exposure to new food items (see Birch, (1987) for a discussion of the influence of food exposure on food preference) resulted in the child’s restrictive eating. Until the relationship of physiological influences or family influences on food preference in autism is determined, it will be difficult to determine which came first the chicken nugget or the egg.

Acknowledgements

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