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Psychometric Properties of the Brief Autism Mealtime Behaviors Inventory

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Abstract

The purpose of this study was to explore the psychometric properties of the Brief Autism Mealtime Behaviors Inventory (BAMBI). In a sample of 273 well-characterized children with ASD, we explored the factor structure of the BAMBI, determined the internal consistency of a newly derived factor structure and provide an empirically derived cut-off for the BAMBI total score. The new psychometrically identified structure consists of 4 factors: 1) Food Selectivity, 2) Disruptive Mealtime Behaviors, 3) Food Refusal and 4) Mealtime Rigidity. Internal consistency was acceptable. A cut off score of 34 is suggested based on our results. The new 15-item BAMB with an alternative 4-factor structure with clinical utility is promising in assessing feeding and mealtime problems in children with ASD.

Keywords

Feeding problems; mealtime behaviors; eating; autism spectrum disorder

Autism Spectrum Disorders (ASD) are neurodevelopmental disorders affecting up to one in 68 children (Center for Disease Control and Prevention, 2014). Core features of ASD include deficits in social, communication behaviors and presence of repetitive and restrictive behaviors (American Psychiatric Association, 2013). While not diagnostic, feeding problems in children with ASD were identified early in the autism literature as indicators for the disorder (Kanner, 1943). An estimated 46–89% of children with ASD exhibit feeding problems (Seiverling et al., 2011) that commonly fall into one of three categories: 1) food selectivity based on type and texture, 2) food refusal, and 3) disruptive mealtime behaviors (Ahearn, Castine, Nault, & Green, 2001; Bandini et al., 2010; Schreck & Williams, 2006; Schreck, Williams, & Smith, 2004; Williams, Gibbons, & Schreck, 2005). This is in contrast to approximately 25% of typically developing children exhibiting similar feeding problems (Ledford & Gast, 2006; Manikam & Perman, 2000; Matson & Fodstad, 2009). In fact, findings from a recent meta-analysis reflect an estimated fivefold increase in the likelihood of a child with ASD having feeding problems compared to typical counterparts (Sharp, Jaquess, Morton, & Herzinger, 2010). Children with ASD are found to not only present more feeding problems than typically developing peers (Lukens & Linscheid, 2008; Schreck et al., 2004), but also atypically developing same age-mates (Matson, Fodstad, & Dempsey,

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2009). Research on the impact of feeding problems on nutrition has been equivocal thus far. Many of the nutritional deficiencies are similar to typically developing children (Herndon, DiGuiseppi, Johnson, Leiferman, & Reynolds, 2009; Hyman et al., 2012). However, a large recently published study demonstrated that nutritional quality diminished as parent reported feeding problems increased (Johnson et al., 2014). Regardless, feeding problems are associated with parental stress and adversely impact family functioning (Kerwin, Eicher, & Gelsinger, 2005; Nadon, Feldman, Dunn, & Gisel, 2011).

The wide prevalence percentage range is likely due to the various methods used to assess feeding problems (Ledford & Gast, 2006). Methodology to assess feeding problems in children with ASD has involved a number of parent-completed questionnaires as well as direct observations procedures (Matson & Fodstad, 2009). Studies determining the prevalence have primarily relied on questionnaires. For example, the Children's Eating Behavior Inventory (CEBI) (Archer, Rosenbaum, & Streiner, 1991) was used to measure eating and mealtime behaviors in children with ASD (Schreck, Williams & Smith, 2004). However, this measure fails to address problem behaviors found in ASD samples, as it was not intended for children with ASD specifically (Seiverling, Williams, & Sturmey, 2010). The Screening Tool of Feeding Problems (STEP) (Matson & Kuhn, 2001) was developed to assess feeding problems in adults with intellectual disabilities. The STEP has been used in ASD populations (Fodstad & Matson, 2008) but is yet to be validated in this sample. Also, the Behavioral Pediatric Feeding Assessment Scale (BPFAS) (Crist & Napier-Phillips, 2001) has also been used in the ASD pediatric feeding problem literature (Martins, Young, & Robson, 2008). Challenges lie in using these measures specifically with children with ASD because often the problems are unique to this population, including sensory feeding problems (Cermak, Curtin, & Bandini, 2010; Lane, Young, Baker, & Angley, 2010; Williams, Dalrymple, & Neal, 2000) and ritualistic and repetitive behaviors found during mealtimes (Schreck & Williams, 2006; Schreck et al., 2004). Direct observation procedures similar to those described by Ahearn and colleagues have oftentimes been used in the single subject treatment literature to monitor response to treatment (Ahearn et al., 2001). In this study, 30 ASD participants were presented with a selection of different foods and textures; acceptance, expulsion, and challenging behaviors were recorded. However, these procedures are time consuming, not always feasible, and usually have been conducted in specialized settings with trained personnel (Piazza, Roane, & Kadey, 2009).

The Brief Autism Mealtime Behavior Inventory (BAMBI) was developed as the first standardized informant report measure to capture mealtime and feeding behaviors explicitly in children with ASD. The BAMBI was developed in response to the limitations of other measures not being sensitive to the behaviors found in children with ASD (Lukens & Linscheid, 2008). Additionally, the measure was created to be brief compared to its counterparts. Lukens and Linscheid developed the measure and its factor structure by comparing the eating habits of children aged 3–11 years with and without ASD. In the sample of 68 children with ASD and 40 typically developing children, significant group differences in the frequency of mealtime behavior were found (Lukens & Linscheid, 2008). Initially a 21-item scale, the BAMBI is now 18 items and is defined by 3-factors: 1) Limited variety, 2) Food refusal, and 3) Features of autism. The Limited Variety factor consists of 8 items that capture the child's willingness to try new foods and food categorized by

preparation, texture, and type. The Food Refusal factor consists of five items that capture the problem behaviors observed when a child rejects a presented food (crying, spitting out food etc.). And finally, the Features of Autism factor includes items that reflect the behavioral characteristics of ASD, such as self-injurious behavior, inattention, and repetitive behaviors during mealtimes. The Features of Autism factor discriminated between the children with ASD and the typically developing controls in the sample. Items in this factor were endorsed as never or rarely occurring in the typically developing controls, while the ASD group endorsed these items as occurring occasionally or often. Surprisingly, the authors used the entire sample (both ASD and non-ASD) to develop the scale, making the factors less generalizable to ASD only. Detailed psychometrics of the BAMBI are further described in the methods section. The BAMBI was recently used in a large study of nutrition in 256 children with ASD showing strong associations between the parent completed BAMBI and repetitive and ritualistic behaviors, sensory features, and externalizing and internalizing behaviors (Johnson et al., 2014).

Most recently, the BAMBI has been validated in a brief paper within a Turkish population. Parents of 308 children with ASD were sampled from Autism Children Education Centers across Turkey. No specific diagnoses were available. The results demonstrated that after 4-items were removed, the translated BAMBI proved to be a valid and reliable scale (Meral & Fidan, 2014). The psychometric properties of the BAMBI were also tested within a population of children in a hospital pediatric feeding clinic (Hendy, Seiverling, Lukens, & Williams, 2013). The study consisted of 202 children (57 children with no special needs, 60 children with ASD, and 85 with other special needs). They found that the BAMBI did not discriminate those children with other special needs, ASD, and children without special needs. Hence, the authors revised the measure so it could be used more widely with children who have feeding problems and a range of clinical diagnostic conditions. The resulting revised BAMBIC (Hendy, Seiverling, Lukens, & Williams, 2013) is a 10-item measure with 3 factors, Limited Variety, Food Refusal, and Disruptive Behavior and is intended for use with special needs children with a range of feeding problems. To our knowledge no other psychometric testing has been done.

The BAMBI has strong potential for clinicians to more easily assess feeding problems in children with ASD, as it examines a range of problem behaviors seen in the ASD population. However, there is a strong need for the BAMBI to be independently validated with a representative sample of children with ASD (Seiverling et al., 2010). The goals of this study were to investigate the psychometric properties of the BAMBI in a large, well characterized ASD sample. Specifically, we extended previous efforts by 1) exploring the factor structure for the BAMBI in a large ASD sample, 2) determining the internal consistency of the derived factor structure within a large sample of children and 3) introducing an empirically derived cut-off for the BAMBI total score based on our results and the literature.

Methods

Sample

Participants for this study were children, ages 2–11 years of age, with ASD who were recruited through the Autism Speaks-Autism Treatment Network (AS-ATN) and Health Resources and Services Administration funded Autism Intervention Research – Physical (AIR-P) to participate in a diet and nutrition study (Hyman et al., 2012; Johnson et al., 2014). Five of the 17 AS-ATN sites participated in this study with each site receiving approval from their respective Institutional Review Board (IRB). Informed consent was obtained for all participants prior to participation and all collected data were de-identified before it was entered into the central database. Diagnoses were based on the DSM-IV criteria (American Psychiatric Association., 2000) and corroborated by the Autism Diagnostic Observation Schedule (ADOS) (Lord, Rutter, DiLavore, & Risi, 1999).

Procedures

Participants were already enrolled in the AS-ATN or were newly enrolled as a part of the AIR-P diet and nutrition study. In addition to collecting the BAMBI, demographic and medical information was routinely collected as a part of the AS-ATN registry. These data were extracted for the present study.

Study Measures

Demographics/Medical—This AS-ATN Registry form collected information about enrolled participants including: age, gender, ethnicity, and parent education level. Past and current medical information was also collected for this study. This form also inquired about whether the parent had any concerns about their child's feeding.

Autism Diagnostic Observation Schedule (ADOS) (Lord et al., 1999) is an investigator-based assessment conducted in naturalistic social situations demanding specific social, communication and restricted/repetitive responses. Although the protocol follows standard administration, the situations themselves are unstructured or semi-structured. Behaviors are scored in the areas of social communication, social relatedness, play and imagination, and repetitive behaviors. This measure was used to confirm clinical diagnosis and provides a severity score.

Developmental/Cognitive functioning was measured as part of the ATN protocol in order to assess each participant's level of intellectual functioning. The Stanford-Binet Edition: Fifth Edition (SB: 5th; Roid, 2003) or the Mullen's Scale of Early Learning (MSEL; Mullen, 1995) were interchangeably used across the different sites to accommodate for participants developmental level. Specifically, the Mullen was used in children with limited language skills or with mental age below 2–3 years. The Stanford-Binet was used in verbal children with mental age above 3–4 years. The Bayley Scales of Mental Development (Bayley, 2006) was also administered at some of the AS-ATN sites. The majority of participants were administered the Stanford-Binet. At a minimum, the abbreviated version of the Stanford-Binet was administered.

Brief Autism Mealtime Behavior Inventory (BAMBI) (Lukens & Linscheid, 2008) is an 18-item parent-report questionnaire that was designed to capture mealtime behaviors specific to children with ASD. The BAMBI is scored on a 1–5 Likert scale with a score of 1 indicating the behavior "never" occurs and a score of 5 indicating the behavior "always" occurs at mealtime. Reversed scoring is used for four of the items rating positive mealtime behaviors. A total frequency score is calculated from a sum of all 18 items with higher scores reflecting more mealtime behavior problems. The authors evaluated the psychometric properties of the measure in a sample comprising both typically developing children (n = 40) and children with ASD (n = 68) between the ages of 3 and 11 years. Their exploratory factor analysis identified 3-factors (Limited Variety, Food Refusal, and Features of Autism). The scale's overall internal consistency was good for the full scale including all 18 items with Cronbach's alpha of .88, and ranged between the 3-factors (.87, .76, and .63). Lukens and Linscheid (2008) found high test retest reliability ($r(33) = 0.87$, $p < .01$) and inter-rater reliability between a parent and teacher or therapist report ($r(16) = 0.78$, $p < .01$). The Limited Variety factor demonstrated strong construct validity when correlated with intake of vegetables as measured by the 24-hour Recall Interview ($r(55) = 0.87$, $p < .05$).

Data Analyses

Data analyses were conducted using PASW statistics AMOS (SPSS Inc, 2010). Descriptive statistics were conducted to define sample characteristics. A confirmatory factor analysis was performed using the original 3-factor structure (Lukens & Linscheid, 2008). Internal consistency for the full BAMBI was calculated using Cronbach's alpha. Model fit indices were selected including Chi Square (with a score of 1–3 indicating good fit), Root Mean Square Error of Approximation (RMSEA; with a score of <.05 indicating good fit), Tucker-Lewis Index (TLI >.95) and Comparative Fit Index (CFI>.90 indicating traditional fit) (Browne, Cudeck, & Bollen, 1993). Subsequently, an exploratory factor analysis was performed on a revised 15 item BAMBI. Internal consistency (Cronbach's alpha) was also assessed for each of the extracted factors. A Receiver Operating Characteristics (ROC) curve was calculated with the newly revised BAMBI using parent-reported feeding concerns to determine the predictive power of the new structure for this feeding measure.

Results

Demographics

The sample included 273 children with ASD (233 male and 40 female; mean age = 5.79 years, SD = 2.51, range = 2–11 years) for whom 1) had complete BAMBIs had been obtained and 2) who met ASD criteria on the ADOS (out of a total of 367 children who had consented to participate in the AIR-P Diet and Nutrition study). Hence 94 participants were excluded as either there was incomplete BAMBI data or ASD criteria was not met on the ADOS. Sixty-three percent of the children met diagnostic criteria for Autistic Disorder while the remaining participants met criteria for autism spectrum disorder (PDD, NOS or Asperger's Disorder). Developmental functioning was also assessed with around half of the participants administered the Stanford-Binet Fifth Edition (SB: 5^{th}) (Roid, 2003) followed by the Mullen's Scale of Early Learning (MSEL) (Mullen, 1995) and the Bayley Scales of Infant and Toddler Development-Third Edition (Bayley, 2006), depending on a child's age

and verbal abilities. The mean standard cognitive score was 81.5 (SD = 23.5, range = 40–142). The mean total BAMBI score was 47.1 (SD = 11.05, range = 21–72).

Factor Analyses

A confirmatory factor analysis was first conducted for the original 3-factor BAMBI structure. Goodness-of-fit indices of interest revealed inadequate goodness-of-fit results: Chi-square=3.7 and RMSEA=0.1 (significant at .05 level indicating rejection of the null hypothesis of close fit), CFI=.758, and TLI=.820. Following, Cronbach's alpha reliability values were mixed with Limited Variety=.765, Food Refusal=.469, and Autism Features=.509. These values (significant RMSEA, low CFI, and low internal consistency) were inadequate to accept the original 3-factor structure.

Subsequently, an exploratory factor analysis was performed on the original 18-items BAMBI. We used the same approach as Lukens and Linscheid (2008); Maximum Likelihood method was specified with the varimax rotation (Lukens & Linscheid, 2008). Examination of the scree plot initially suggested that models with 2–4 factors be extracted from the rotated factor matrix. Items with loadings <0.25 were eliminated from the structure. From reviewing the alternative factor models and their loadings, items 12, 14, and 17 were removed as they failed to fit the loading criteria. Item 12 (refuses to eat foods that require a lot of chewing) was removed as it didn't load conceptually on the factors; item 14 (prefers "crunchy" foods) was removed resulting in an increase in Cronbach's alpha from 0.68 to .82 for the corresponding factor; and item 17 (prefers only sweet foods) was removed as did not load >.19 on any of the factors (41% of parents rated a 0 for this item). Lastly, although item 3 (remains seated at table until meal is finished) loaded weaker at only .284, it was kept given its clinical significance. The RMSEA values for the 2-factor solution=.102 and 3-factor=.090 indicated mediocre fits, while the 4-factor solution=.063 indicated a reasonable fit (Browne et al., 1993). The 4-factor model displayed an acceptable Chi Square value of 1.9, and moderate fit values for CFI=.940 and TLI=.923. The 2-factor model was eliminated due to a high RMSEA value, and being less clinically informative. The 3-factor model also had inadequate model fit indices, and many low loading factors that were often clinically unrelated items. Therefore, using the scree plot, factor loadings, model fit indices, and grouping of clinically related items, the 4-factor solution was identified as the best factor solution. Table 1 provides the factor loading for the 4-factor solution.

The four factor solution explains 49.5% of the total variance. The factors were labelled as 1) Food Selectivity, 2) Disruptive Mealtime Behaviors, 3) Food Refusal, 4) Mealtime Rigidity. The first factor has 4 items capturing the limited variety of foods eaten by the child with a mean factor loading of .695. The second factor has 5 items describing problem behaviors during mealtime with a mean factor loading of .563. The third factor has three items which capture behaviors when food is refused by the child and has a mean factor loading of .600. The final factor has a mean factor loading of .582 with three items describing the child's inflexible preferences for mealtime routines. Internal consistency as measured by Cronbach's alpha for the total 15-item BAMBI was .835. The internal consistency for the four factors is as follows: Limited Variety=.824, Disruptive mealtime behaviors=.688,

Refusal=.824 and Mealtime Rigidity=.674. From an empirical and clinical standpoint, the four-factor solution appeared to be the strongest and most interpretable.

Cut-Off Score

The sensitivity and specificity for the modified BAMBI were examined using a Receiver Operating Curve (ROC). Children with problematic feeding were identified via parent-report in a yes/no format as collected by the AS-ATN registry. Two-hundred-nineteen parents out of the 273 total participants indicated problematic feeding with their child. Using this criterion, the area under the curve was determined and shown to be .834 with a 95% confidence interval (.773, .894), indicated an acceptable level of predictive power for the 15-item BAMBI. Selecting a cut off score of 34 as the total score on the BAMBI, sensitivity was .758 and specificity was .241. With a cut-off total score of 34, 81% of problematic feeders were identified on both the BAMBI and parent-report (178 of the 219 children were identified). It should be noted that there was not a cut off score previously recommended for the original BAMBI.

Discussion

The purpose of this study was to investigate the psychometric properties of the BAMBI in a large sample of well characterized children with ASD. The analyses included 273 children with ASD between the ages of 2–11 years with an average age of nearly 6 years. This sample was considerably larger than the developers of the BAMBI who proposed a 3-factor structure (Lukens & Linscheid, 2008). Our initially conducted CFA results failed to meet acceptable goodness of fit indices and thus, did not support the original 3-factor structure. Therefore, a new structure was developed using an exploratory factor analysis. Three items were removed as they failed to meet loading criteria and conceptual significance (refuses to eat foods that require a lot of chewing; prefers “crunchy” foods; prefers only sweet foods); the remaining 15 items make up the new empirically supported structure. The new psychometrically identified structure consists of 4 factors identified as: 1) Food Selectivity, 2) Disruptive Mealtime Behaviors, 3) Food Refusal and 4) Mealtime Rigidity. Moreover, in addition to the suitable mean factor loadings, the internal consistency of the four factors was acceptable. These four factors are consistent with common feeding problems reported in children with ASD (Ahearn et al., 2001; Bandini et al., 2010; Schreck & Williams, 2006; Schreck et al., 2004; Williams et al., 2005).

The first factor labelled Food Selectivity has 4 items and refers to the limited foods accepted by the child. The second factor, Disruptive Mealtime Behaviors, includes aggressive and maladaptive behaviors present at mealtimes and is captured in 5 items. One of the items in this factor, item 3, had a lower loading of .284 but was included in this factor given its clinical relationship with the other items. Conversely, items 4 and 9 loaded high on this factor but were included on factor 3 and factor 4 respectively. They loaded high on these factors and made a more coherent clinical picture. The third factor comprising 3 items, Food Refusal, highlights behaviors that the child does when refusing foods. Lastly, the final 3 items correspond with Mealtime Rigidity and describe limited flexibility with feeding and mealtime routines. Collectively, each of the new factors captures a cluster of behaviors that

will be informative for goal setting and behaviorally-based treatment planning. This paper has also offered a cut-off score of 34 based off the new structure of the BAMBI. We found that close to 80% of our sample had identified feeding problems. With the cut-off score at 34, we were able to identify 81% of these problematic feeders within the sample.

While these newly identified factors are similar to the original 3-factor model, a major difference is that our study failed to replicate the 'Features of Autism' factor, which identified behavioral characteristics of ASD. It is noteworthy to mention that in the original paper (Lukens & Linscheid, 2008), the mean difference for this factor was not very large between the typically developing and the ASD group, suggesting a weak factor. In addition, the Features of Autism scale in the BAMBI has been found not to correlate with the Social Responsiveness Scale (SRS) total score which measures severity of ASD symptoms (Sharp, Jaquess, & Lukens, 2013). This lack of association between feeding behaviors and ASD symptoms has been reported in other studies (Johnson et al., 2014; Schreck & Williams, 2006) implying that features of ASD and feeding behaviors may be relatively independent. Notably, in the original paper the authors used the combined sample of both children with ASD and typically developing controls in their factor analysis. This combined group of children with and without ASD along with a considerably smaller sample size which may have led to dissimilar findings. The original Limited Variety factor captures a plethora of feeding behaviors that our new structure separates into Food Selectivity and Mealtime Rigidity. Surprisingly, the removal of the two items which captured textural and 'chewing' behaviors improved the current factor structure significantly despite the literature suggesting a relationship between sensory issues and feeding problems in children with ASD (Cermak et al., 2010; Lane et al., 2010; Williams et al., 2000). Perhaps there were insufficient items in this area and that more items specific to primary sensory issues related to feeding might result in another factor. At present, the BAMBI items may be capturing the consequences of sensory sensitivities by way of food selectivity, disruptive mealtime behaviors and food refusal.

Weaknesses

A limitation of the current study is that the validity of this new structure was not confirmed with a previously validated measure; future studies should aim to confirm the newly identified factors. Additionally, our sample comprised of children from a relatively young age range which may not be representative of feeding behaviors exhibited by older children with ASD. Also, the stability of the measure over time was not measured, as it was only collected at one time-point. Lastly, parent report was also used as an indicator for cut-off score in the future, a combination of parental report and clinical judgment would be a stronger predictor.

Future Directions

Considering the limitations of this study some future directions are recommended. It would be beneficial to replicate these findings with a large representative sample of children with ASD, perhaps in a clinical setting. The use of the BAMBI in combination with other methodologies such as direct observation would be beneficial in creating the most comprehensive assessment. Also, the introduction of additional items to cover a wider range

of behaviors may be warranted. For example, items related to sensory issues as well as mealtime rituals (e.g. having to eat with certain utensils, only eating at a particular table) may strengthen the measure.

Summary & Clinical Implications

To date, no other measure other than the BAMBI has been developed specifically to assess feeding problems in children with ASD. The new 15-item BAMBI shows promise as a measure for assessing the specific feeding problems most prominent in children with ASD. The present study of a large, well characterized sample of children with ASD offered an alternative 4-factor structure with clinical utility. That is, the 4-factors could inform the selection of treatment targets in intervention. The ease of using a brief questionnaire will allow use in community clinics, educational settings, and other less specialized programs. The current study also provides a total score cut-off for identifying children with ASD with feeding problems using the new proposed 15- item BAMBI. This allows for the BAMBI total score to be broadly used as a screening measure in a variety of services providing care rather than in just specialized feeding clinics. While specificity was low, sensitivity was high. Given the frequency of feeding problems in ASD, having a psychometrically sound measure is imperative.

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References

Ahearn W, Castine T, Nault K, Green G. An assessment of food acceptance in children with with autism and pervasive developmental disorder-not otherwise specified. Journal of Autism and Developmental Disorders. 2001; 31:505–511. [PubMed: 11794415]

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5. Washington, DC: American Psychiatric Association; 2013.

American Psychiatric Association. Diagnostic criteria from DSM-IV-TR. Washington, D.C: American Psychiatric Association; 2000.

Archer LA, Rosenbaum PL, Streiner DL. The children's eating behavior inventory: reliability and validity results. Journal of Pediatric Psychology. 1991; 16(5):629–642. [PubMed: 1744810]

Bandini LG, Anderson SE, Curtin C, Cermak S, Evans EW, Scampini R, Must A. Food selectivity in children with Autism Spectrum Disorders and typically developing children. The Journal of Pediatrics. 2010; 157(2):259–264. [PubMed: 20362301]

Bayley, N. Bayley scales of infant and toddler development: Bayley-III. Harcourt Assessment, Psych. Corporation; 2006.

Browne MW, Cudeck R, Bollen KA. Alternative ways of assessing model fit. Sage Focus Editions. 1993; 154:136–136.

Center for Disease Control and Prevention. Prevalence of autism spectrum disorder among children aged 8 years-autism and developmental disabilities monitoring network, 11 sites, United States, 2010. Morbidity and mortality weekly report Surveillance summaries (Washington, DC: 2002). 2014; 63:1.

Cermak SA, Curtin C, Bandini LG. Food selectivity and sensory sensitivity in children with autism spectrum disorders. Journal of the American Dietetic Association. 2010; 110(2):238–246.10.1016/j.jada.2009.10.032 [PubMed: 20102851]

Crist W, Napier-Phillips A. Mealtime behaviors of young children: a comparison of normative and clinical data. Journal of Developmental and Behavioral Pediatrics. 2001; 22(5):279–286. [PubMed: 11718230]

Fodstad JC, Matson JL. A comparison of feeding and mealtime problems in adults with intellectual disabilities with and without autism. Journal of Developmental and Physical Disabilities. 2008; 20(6):541–550.

Hendy HM, Seiverling L, Lukens CT, Williams KE. Brief Assessment of Mealtime Behavior in Children: Psychometrics and Association With Child Characteristics and Parent Responses. Children's Health Care. 2013; 42(1):1–14.

Herndon AC, DiGuiseppi C, Johnson SL, Leiferman J, Reynolds A. Does nutritional intake differ between children with autism spectrum disorders and children with typical development? Journal of Autism and Developmental Disorders. 2009; 39(2):212–222. [PubMed: 18600441]

Hyman S, Stewart P, Schmidt B, Cain U, Lemcke N, Foley J, Ng P. Nutrient intake from food in children with autism. Pediatrics. 2012; 130(Supplement 2):S145–S153. [PubMed: 23118245]

Johnson CR, Turner K, Stewart PA, Schmidt B, Shui A, Macklin E, Hyman SL. Relationships Between Feeding Problems, Behavioral Characteristics and Nutritional Quality in Children with ASD. Journal of Autism and Developmental Disorders. 2014:1–10.10.1007/s10803-014-2095-9

Kanner L. Autistic disturbances of affective contact. Nervous child. 1943; 2(3):217–250.

Kerwin M, Eicher PS, Gelsinger J. Parental report of eating problems and gastrointestinal symptoms in children with pervasive developmental disorders. Children's Health Care. 2005; 34(3):217–234.

Lane AE, Young RL, Baker AE, Angley MT. Sensory processing subtypes in autism: association with adaptive behavior. Journal of Autism and Developmental Disorders. 2010; 40(1):112–122.10.1007/s10803-009-0840-2 [PubMed: 19644746]

Ledford JR, Gast DL. Feeding problems in children with Autism Spectrum Disorders: A review. Focus on Autism and Other Developmental Disabilities. 2006; 21(3):153–166.

Lord, C.; Rutter, M.; DiLavore, P.; Risi, S. Autism diagnostic observation schedule-WPS edition. Los Angeles, CA: Western Psychological Services; 1999.

Lukens CT, Linscheid TR. Development and validation of an inventory to assess mealtime behavior problems in children with autism. Journal of Autism and Developmental Disorders. 2008; 38:342–352. [PubMed: 17578658]

Manikam R, Perman JA. Pediatric feeding disorders. Journal of Clinical Gastroenterology. 2000; 30(1):34–46. [PubMed: 10636208]

Martins Y, Young RL, Robson DC. Feeding and eating behaviors in children with autism and typically developing children. Journal of Autism and Developmental Disorders. 2008; 38(10):1878–1887. [PubMed: 18483843]

Matson JL, Fodstad JC. The treatment of food selectivity and other feeding problems in children with autism spectrum disorders. Research in Autism Spectrum Disorders. 2009; 3(2):455–461.

Matson JL, Fodstad JC, Dempsey T. The relationship of children's feeding problems to core symptoms of autism and PDD-NOS. Research in Autism Spectrum Disorders. 2009; 3(3):759–766.

Matson JL, Kuhn DE. Identifying feeding problems in mentally retarded persons: Development and reliability of the screening tool of feeding problems (STEP). Research in Developmental Disabilities. 2001; 22(2):165–172. [PubMed: 11325163]

Meral BF, Fidan A. A Study on Turkish Adaptation, Validity and Reliability of the Brief Autism Mealtime Behavior Inventory (BAMBI). Procedia-Social and Behavioral Sciences. 2014; 116:403–408.

Mullen, E. Mullen Scales of Early Learning. Circle Pines: American Guidance Service; 1995. (AGS Edition ed.)

Nadon G, Feldman DE, Dunn W, Gisel E. Mealtime problems in children with autism spectrum disorder and their typically developing siblings: a comparison study. Autism. 2011; 15(1):98–113.10.1177/1362361309348943 [PubMed: 20484003]

Piazza, CC.; Roane, HS.; Kadey, HJ. Treating Childhood Psychopathology and Developmental Disabilities. Springer; 2009. Treatment of pediatric feeding disorders; p. 435-444.

Roid, GH. Stanford-Binet Intelligence Scales: Examiner's Manual. 5. Itasca, IL: Riverside; 2003.

Schreck KA, Williams K. Food preferences and factors influencing food selectivity for children with autism spectrum disorders. Research in Developmental Disabilities. 2006; 27(4):353–363. [PubMed: 16043324]

Schreck KA, Williams K, Smith AF. A comparison of eating behaviors between children with and without Autism. Journal of Autism and Developmental Disorders. 2004; 34(4):433–438. [PubMed: 15449518]

Seiverling L, Williams K, Sturmey P. Assessment of feeding problems in children with autism spectrum disorders. Journal of Developmental and Physical Disabilities. 2010; 22(4):401–413.

Seiverling, LJ.; Williams, KE.; Ward-Horner, J.; Sturmey, P.; Matson, JL.; Sturmey, P. International Handbook of Autism and Pervasive Developmental Disorders. New York: Springer; 2011. Interventions to treat feeding problems in children with autism spectrum disorders: a comprehensive review; p. 491-508.

Sharp WG, Jaquess DL, Lukens CT. Multi-method assessment of feeding problems among children with autism spectrum disorders. Research in Autism Spectrum Disorders. 2013; 7(1):56–65.

Sharp WG, Jaquess DL, Morton JF, Herzinger CV. Pediatric feeding disorders: a quantitative synthesis of treatment outcomes. Clinical Child and Family Psychology Review. 2010; 13(4):348–365.10.1007/s10567-010-0079-7 [PubMed: 20844951]

SPSS Inc. Predictive Analytic SoftWare (PASW). Chicago, IL: SPSS Inc; 2010.

Williams KE, Gibbons B, Schreck KA. Comparing selective eaters with and without developmental disabilities. Journal of Physical and Developmental Disabilities. 2005; 17:299–309.

Williams PG, Dalrymple N, Neal J. Eating habits of children with autism. Pediatric Nursing. 2000; 26:259–264. [PubMed: 12026389]

Table 1

Factor loadings for the BAMBI (4-Factor Solution)

	Factor Loadings			
	Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
15. Accepts or prefers a variety of foods	**.839**	.048	.192	.118
10. Is willing to try new foods	**.757**	.125	.237	.088
13. Prefers the same foods at each meal	**.650**	.118	.206	.276
11. Dislikes certain foods and won't eat them	**.532**	.051	.033	.160
7. Is disruptive during mealtimes	.107	**.775**	.150	.071
5. Is aggressive during mealtimes	.016	**.658**	.117	.111
1. Cries or screams during mealtime	.251	**.640**	.261	−.106
6. Displays self-injurious behavior during mealtimes	−.106	**.456**	.088	.155
3. Remains seated at the table until meal is finished	.179	**.284**	.063	.061
4. Expels food that he/she has eaten	.068	.331	**.320**	.121
2. Turns his/her face or body away from food	.247	.269	**.928**	.074
8. Closes mouth tightly when food is presented	.289	.208	**.553**	.048
16. Prefers to have food served in a particular way	.147	.112	.073	**.769**
18. Prefers to have food prepared in a particular way	.335	.137	.063	**.651**
9. Is flexible about mealtime routines	.177	.356	.041	**.325**