

Intervention for Food Selectivity in a Specialized School Setting: Teacher Implemented Prompting, Reinforcement, and Demand Fading for an Adolescent Student with Autism

Maria Knox, Hanna C. Rue, Leah Wildenger, Kara Lamb,
and James K. Luiselli

May Institute

Abstract

Food selectivity is a common problem among children and youth who have intellectual and developmental disabilities or autism spectrum disorders. Whereas most intervention research has been conducted under simulated conditions in clinic and hospital settings, this study evaluated teacher implemented procedures at a specialized school. The participant was an adolescent girl who had autism, chronic food selectivity, and disruptive mealtime behavior. Before intervention, she ate a restrictive diet comprised primarily of "crunchy" foods. During intervention, teachers applied paced-prompting, differential positive reinforcement, and demand fading to gradually increase the quantity of novel foods the girl consumed. Her improved consumption maintained seven-months post-intervention. We discuss elements of the intervention plan and a focus on natural-setting feeding research.

KEYWORDS: applied behavior analysis, autism, changing criterion design, food selectivity, paced prompting

Food selectivity, the limited consumption of foods based on texture, taste, and familiarity is a common problem among children with autism (Johnson, Handen, Mayer-Costa, & Sacco, 2008; Ledford & Gast, 2006; Luiselli, 2006). To illustrate, a child with food selectivity may consume crunchy textured items such as chips, crackers, and dry cereal but avoid softer texture foods like yogurt and fruits. Children who demonstrate selective eating have restricted diets that can cause malnutrition, dehydration, and similar health concerns (Cornish, 1998; Emond, Emmett, Steer, & Golding, 2010). Feeding intervention may also be a priority even when health risks are not imminent (Ledford & Gast, 2006). For example, children with autism and food selectivity

Maria Knox and Hanna C. Rue are now at National Autism Center, Leah Wildenger is now at Children's Hospital, Boston, and Kara Lamb is now at Apex Behavioral Consulting.

Correspondence to Maria Knox, National Autism Center, Randolph, MA 02368; e-mail: mknox@nationalautismcenter.org.

usually display interfering behaviors when care-providers introduce novel foods and try to prompt consumption (Najdowski et al., 2008).

Applied behavior analysis (ABA) has been effective in overcoming food selectivity (Bass & Kroeger, 2011; Williams & Foxx, 2007). Consequence-based procedures such as positive reinforcement (Piazza, Patel, Gulotta, Sevin, & Layer, 2003) and access to preferred stimuli (Luiselli & Gleason, 1987; Riordan, Iwata, Wohl, & Finney, 1980) have been used to increase appropriate eating and escape extinction have been implemented to decrease mealtime problem behavior (Ahearn, Kerwin, Eicher, & Lukens, 2001; Piazza et al., 2003). Antecedent-based procedures are implemented to promote acceptance of novel foods and to prevent problem behaviors that interfere with feeding, for example, food blending (Tiger & Hanley, 2006), sequential and simultaneous presentation of foods (Kern & Marder, 1996), demand fading (Luiselli, 2000; Luiselli, Ricciardi, & Gilligan, 2005; Najdowski, Wallace, Doney, & Ghezzi, 2003), and behavioral momentum (Dawson et al., 2003). Typically, intervention plans for food selectivity combine these and other consequence-based and antecedent-based procedures. As one example, Piazza et al. (2003) compared the effects of positive reinforcement with escape extinction, positive reinforcement alone, and escape extinction alone on food refusal of 4 children with intellectual disabilities. The type of escape extinction was non-removal of the spoon and physically guiding the mouth open by applying gentle pressure. Positive reinforcement was delivered through praise and access to preferred toys. Piazza et al. (2003) found that escape extinction alone, but not positive reinforcement alone, increased food consumption by all of the children. However positive reinforcement decreased problem behaviors when it was combined with escape extinction.

Tarbox, Schiff, and Najdowski (2010) acknowledged that "most behavioral feeding research has included trained experimenters as feeders, often in clinical or hospital settings" (p. 231). Selected studies have documented that care-providers such as parents can be taught to implement feeding intervention procedures in their homes and in restaurants (Gentry & Luiselli, 2008; Najdowski et al., 2003; Mueller et al., 2003; Tarbox et al., 2010). However, food selectivity research with other care-providers such as teachers has not been frequently reported. Because children with disabilities spend many hours at school, schools represent an appropriate natural setting for conducting feeding research and teachers are a reasonable choice for implementer in treatment of food selectivity.

In the present study, teachers at a specialized community school conducted intervention with an adolescent-age girl to overcome her chronic food selectivity. Because the girl had a history of feeding-re-

sistant behavior, we evaluated a non-invasive intervention plan that combined paced-prompting (Luiselli, 1988), differential reinforcement (Werle, Murphy, & Budd, 1993), and demand fading procedures (Luiselli, 2000; Najdowski et al., 2003, 2008). Follow-up maintenance data were also recorded to document post-intervention effects on food selectivity.

Method

Participant

Anna was a 16-year old girl who was diagnosed by a pediatric neurologist as having autism spectrum disorder (ASD). She attended a school for children and youth with developmental disabilities 6 hours each weekday. Anna could communicate verbally, was able to make requests, and followed single-step and multiple-step instructions. Her Individualized Education Program (IEP) concentrated on pre-academic, self-care, daily living, and social skills.

For many years preceding the study, Anna's diet consisted primarily of a few brand-specific crackers, dry cereal, and apple juice. Her parents reported that she would not eat other foods such as pasta, meat, poultry, fruits, and vegetables. Anna could feed herself independently and did not have a medical condition or food allergies that contributed to her food selectivity. Although she was underweight for her age, growth was within normal limits.

Setting

The study was conducted at Anna's school during the lunch meal in either her classroom or the cafeteria. The lunch duration was 30 minutes. In the classroom, Anna ate at her desk while in the cafeteria she ate at a table with 4-5 of her peers among 20-30 students in attendance. Approximately 25% of lunch meals in the study were conducted in the classroom and 75% of lunch meals were conducted in the cafeteria.

Measurement

Either the primary classroom teacher or one of four assistants conducted measurement and intervention with Anna during the lunch meal. Each meal included a starch, dairy, vegetable, and protein food in serving sizes that were indicated on the food packaging labels. A meal was comprised of one main food (chicken nuggets, macaroni and cheese, or turkey and cheese sandwich) and two side foods (cheese cubes, vegetable chips, carrots, mandarin oranges, or apples). Anna's mother requested that these foods be included in the study given their nutritional value and Anna's history of food refusal

when they were presented to her. After 4 meals, and through consultation with an occupational therapist, carrots were removed from the food options because Anna consumed them without fully chewing each piece.

The one main food and the two side foods comprising the lunch meal were varied each day so that Anna was exposed to all of the foods approximately the same number of times during the study. The teacher or assistant weighed the combined foods on a digital scale (Tanita Digital Scale Model KD4063601) before presenting them to Anna. Following lunch, the teacher or assistant weighed the foods remaining on Anna's plate in the same manner. Food weights were computed in grams. The dependent measure in the study was percentage of the lunch meal that Anna consumed (i.e., $\text{post-meal weight/pre-meal weight} \times 100$). Note that she never spilled food, spit food out, or threw food so all food that left her plate was chewed and swallowed?

To assess interobserver agreement (IOA), a second person independently recorded pre-meal and post-meal food weights during 30% of meals distributed throughout the study. IOA, which was 100% on all occasions, was calculated by dividing the smaller recorded percentage of meal consumed by the larger percentage of meal consumed and multiplying by 100.

Experimental Design and Procedures

The study was a changing criterion design (Hartmann & Hall, 1976) in which Anna was required to eat progressively larger quantities of food.

Baseline. The teacher or assistant placed full portions of the three foods on a paper plate, stated, "Anna, eat your lunch," and presented the plate to her. During the meal the teacher or assistant did not interact with Anna, instruct her further, or implement consequences following consumption and non-consumption of the foods. The teacher or assistant terminated the meal if Anna either consumed all the foods or 30 minutes elapsed, whichever came first. Also, the meal was terminated when Anna did not consume a single portion of food 2.5 minutes after the meal started or when 2.5 minutes elapsed following her last consumed bite. These termination criteria were imposed because they allowed Anna to escape feeding demands without becoming disruptive. When a meal was terminated, the teacher or assistant waited 10 minutes and then allowed Anna to eat her preferred foods.

Pre-Intervention Training. The first author conducted training with the teacher and assistants before they implemented intervention with Anna. During a single training session, she (a) distributed and reviewed a written feeding intervention plan, (b) demonstrated

the respective procedures, and (c) observed the teacher and assistants practicing implementation. The first author also provided verbal performance feedback (praise and correction) during her observation and answered questions about the plan. After training she monitored the teacher and assistants by scheduling routine intervention integrity assessments.

Intervention. To enhance Anna's discrimination of the feeding expectations and the criterion for reinforcement, the teacher or assistant placed three different colored bowls on three separate paper plates. Each bowl and paper plate contained one of the lunch foods in portions specified by the demand fading protocol (described below). The teacher or assistant presented the plates/bowls to Anna and stated "If you eat what is in the (color) bowl, you will get (reinforcer)." Anna could independently and freely access food from the bowls and plates.

Positive Reinforcement. Throughout the meal, the teacher or assistant praised Anna when she picked up foods from the colored bowls, placed them in her mouth, chewed, and swallowed the contents. When Anna consumed each of the three foods that were contained in the colored bowls she received a sticker (one sticker per food) and placed the stickers on a chart (the colored bowls remained on the plates). The teacher or assistant also had Anna choose one of several small objects that she valued (bracelet, necklace, stuffed animal). Thus, the positive reinforcement component of the feeding intervention plan included primary (objects) and secondary (praise, stickers) reinforcers. These reinforcers were selected by asking the teacher and assistants to identify "the things that you think Anna enjoys most."

Paced Prompting. If Anna did not take a bite of food 30 seconds after she swallowed the preceding bite, the teacher or assistant stated, "Anna, eat your lunch". This verbal prompt was delivered one time without additional comments or physical intervention. The purpose of paced-prompting was to prevent Anna from pausing for lengthy periods between bites.

Demand Fading. This procedure involved gradually increasing the amount of food Anna had to consume to gain reinforcement. During the initial three meals of intervention, 20% of each food was placed in the colored bowls (i.e., the criterion for reinforcement) and 80% of each food was placed on the paper plates. When Anna consumed all of the foods in the colored bowls at this criterion over three consecutive meals, the amount of food placed in the colored bowls was increased to 40% and the amount of food placed on the paper plates was decreased to 60%. The in-bowl food quantities continued to be increased 20% and the on-plate food quantities decreased by 20% systematically until 100% of the foods was contained in the colored bowls. Whenever

Anna consumed all of the foods in the colored bowls at the 20%, 40%, 60%, and 80% criterion the teacher or assistant asked her, "Would you like to eat more?" Anna could then either eat the remaining food on the plate or wait until other students finished their meal. At the 100% criterion the full quantities of foods were in the colored bowls.

Similar to the conditions in the baseline phase, intervention meals terminated when Anna either consumed all of the foods in the colored bowls or 30 minutes elapsed, whichever came first. Unlike baseline, the teacher or assistant did not terminate the meal if Anna did not consume a single portion of food with 2.5 minutes of the start of the meal or when 2.5 minutes elapsed following her last consumed bite. Finally, the teacher or assistant continued to wait 10 minutes after the meal terminated before allowing Anna to eat her preferred foods, if she desired.

Follow-up. We recorded Anna's food consumption of the targeted foods 2 weeks, 6 weeks, and 7 months post-intervention. At the 2-weeks follow-up, one of the three colored bowls had been removed from the respective paper plate. At the 6-weeks and 7-months follow-up all of the bowls had been removed. Further changes from the original feeding intervention plan, in effect at all three of the follow-up assessments, were: (a) Anna received one sticker at the end of the meal instead of one sticker for each of the three foods, (b) teacher verbal praise was delayed until the end of the meal, and (c) tangible reinforcement was presented at the end of the week (Friday) and not after every meal. All of the procedural changes introduced at follow-up were intended to fade the intensity of intervention by reducing implementation demands and maintaining Anna's improved consumption under more naturalistic conditions.

Intervention Integrity Assessment

During 80% of lunch meals the first author assessed intervention integrity by observing the teacher implementing the feeding plan with Anna. The observer used a checklist to record whether the teacher implemented each step of the procedure accurately or inaccurately. Each step was scored as accurate only if there was not a single error in implementation throughout the entire meal. Intervention integrity was calculated by dividing the number of accurately implemented steps by the total number of steps in the procedure and multiplying by 100. All of the intervention integrity assessments were 100%.

Social Validity. Social validity was assessed by having the senior teacher who conducted the intervention during the majority of lunch meals complete the *Intervention Rating Profile (IRP-15)*: Martens, Witt, Elliott, & Darveaux, 1985) when the intervention phase concluded.

The *ITP-15* is a 15-item Likert-type scale that measures intervention acceptability. Scores range from 15 to 90 with scores above 52.5 indicating acceptability (Von Brock & Elliott, 1987). The *IRP-15* score by the teacher was 88 indicating very high acceptability.

Results

Figure 1 shows the percentage of the total food in each lunch meal that Anna consumed during baseline, intervention, and follow-up phases. In the first two meals of the baseline phase she ate 15% and 45% of the food followed by two consecutive meals with 0% consumption. Anna displayed mild problem behaviors during the four baseline meals. Referencing the intervention phase, Anna achieved and exceeded the 20% consumption criterion during three consecutive meals; thereafter, she matched the 40%, 60%, 80%, and 100% criteria except for two meals in which she did not eat. Throughout intervention Anna only displayed mild problem behaviors during these non-feeding meals. At each of the follow-up meals her consumption was 100%.

Discussion

The participant in this study had long-standing food selectivity and a history of reacting negatively when requested to eat novel foods. Accordingly, our intervention provided praise and high-preference tangible reinforcers contingent on her consuming small food quantities that increased gradually over successive meals. Paced-prompting was implemented infrequently and was included during intervention to sustain an acceptable rate of feeding. Of significance, at follow-up she consumed 100% of her meals and exhibited no problem behaviors. Whereas clinicians frequently conduct feeding research under simulated conditions (Najdowski et al., 2003), the present study was performed in the participant's school with teaching staff implementing all of the procedures. Our efforts to "normalize" Anna's meals during intervention included presenting her with more than one food and systematically varying the combination of foods each day. The follow-up data also revealed that elements of the intervention plan could be successfully faded and ultimately eliminated; however, the study was not designed to conduct a component analysis of the factors that might have contributed to maintenance.

Anna unexpectedly ate small portions of the novel foods during the first two baseline meals. She may have been unsure about meal-time expectations or may possibly have been motivated to sample foods that she had previously refused but had not been exposed to for some time. We observed that she engaged in problem behaviors

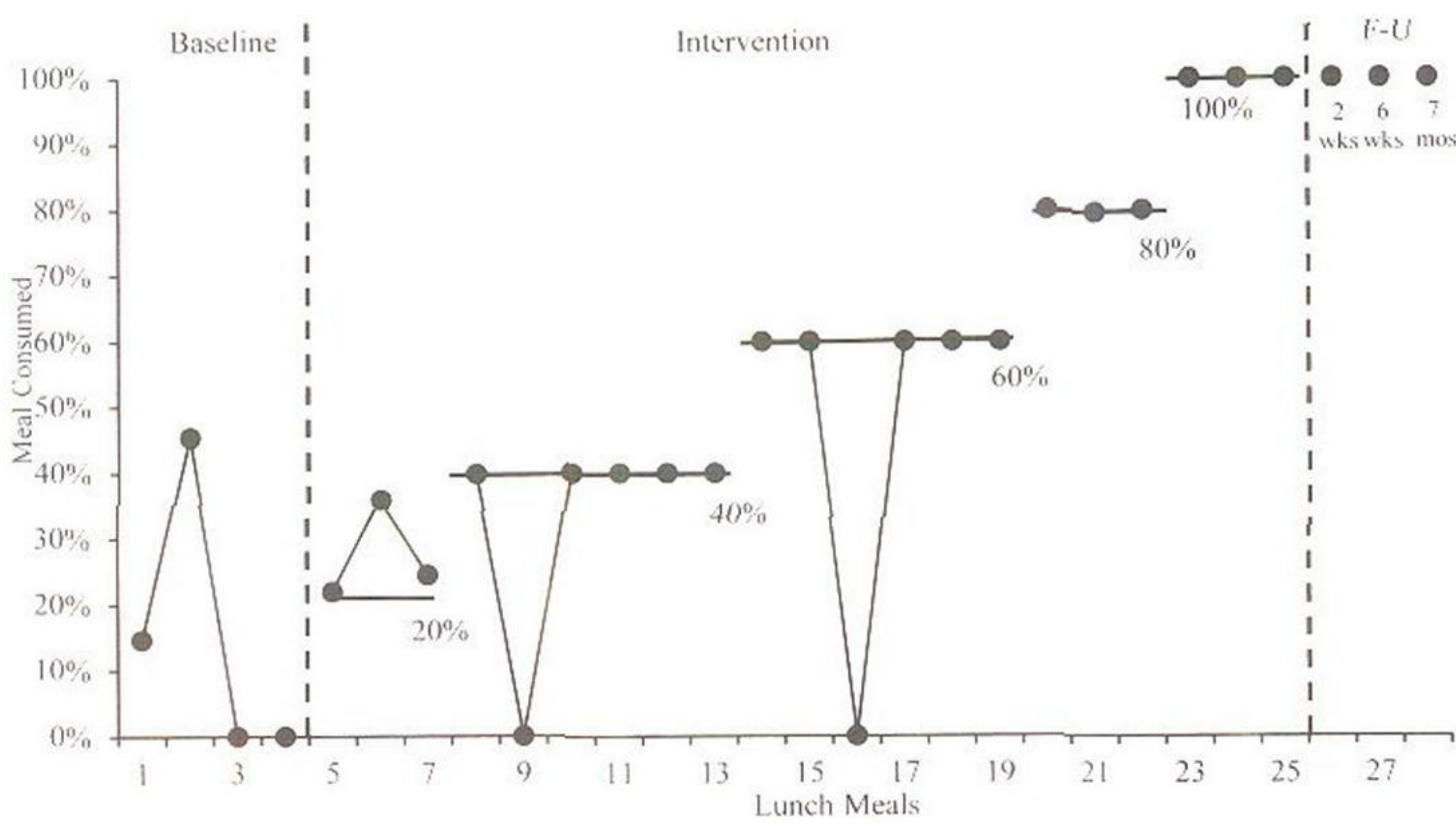


Figure 1. Percentage of total volume of each lunch meal Anna consumed during baseline, intervention, and follow-up phases.

during the baseline meals, specifically, disruptive vocalizing, motor agitation, and pushing plates out of her reach. With the exception of 2 meals in which she did not consume food, these behaviors were rarely encountered during intervention.

As noted, lunch meals during baseline and intervention phases terminated when Anna either consumed all of her food (i.e., on plate or in colored bowls) or 30 minutes elapsed, whichever came first. There were also additional criteria during baseline which were intended to prevent problem behaviors by stopping the meal when Anna did not eat with 2.5 minutes of the onset of the meal or delayed at least 2.5 minutes between bites. One could speculate that Anna might have consumed a larger percentage of her meals in baseline if these criteria had not been imposed. Another interpretation is that the absence of these criteria during intervention functioned as a form of escape extinction by which long delays in food consumption did not terminate the meal. One suggestion for future research is to evaluate the effects of different meal termination criteria on selective eating and food refusal (Tarbox et al., 2010).

A limitation of the study is that we did not record direct eating behaviors during meals. Instead, pre-meal and post-meal food weight differential was used exclusively to document Anna's consumption. Observations confirmed that once Anna placed food in her mouth, she always chewed and swallowed it without rejection, expulsion or spilling. One reason we did not record frequency of bites consumed was that Anna typically ate small mouthfuls of food. However, including

bite frequency with food percentage would have been a more robust and direct measure of consumption. Another limitation is that we described and reported problem behaviors anecdotally without recording data during meals. Furthermore, without a component analysis it is unclear which of the intervention procedures were responsible for Anna consuming novel foods.

Consistent with the methodology of the changing criterion design (Hartmann & Hall, 1976), experimental control in this study was demonstrated by showing that, with two exceptions, Anna consistently achieved the imposed food consumption percentage each time it increased. Indeed, the changing criterion design is useful for evaluating the effects of gradual shaping on skill acquisition. However, more persuasive control could have been demonstrated by briefly returning Anna to a previous criterion in the demand fading protocol and then advancing forward. For example, after achieving the 60% food consumption criterion, conditions could shift back to 40% and subsequently 60% again. These criterion manipulations would have constituted mini-reversals. Conducted several times and with associated changes in consumption, the reversals would have strengthened the design considerably.

Lastly, although this study was conducted at a specialized school, we suggest that similar procedures could be extended successfully to other settings. Notably, the teacher and assistants who implemented measurement and intervention with Anna did not have prior experience with food selectivity. The initial training was brief yet supported good intervention integrity. Certainly, more extreme cases of food selectivity could have medical complications which dictate treatment outside of school. However, our data suggest that at least some students with milder forms of food selectivity who do not exhibit extreme problem behavior can receive intervention at school and as a component of their educational program.

References

- Ahearn, W. H., Kerwin, M. E., Eicher, P. S., & Lukens, C. T. (2001). An ABAC comparison of two intensive interventions for food refusal. *Behavior Modification, 25*, 385-405.
- Bass, J. D., & Kroeger, K. A. (2011). Feeding. In J. K. Luiselli (Ed.), *Teaching and behavior support for children and adults with autism spectrum disorder: A practitioner's guide* (pp. 73-80). New York, NY: Oxford University Press.
- Cornish, E. (1998). A balanced approach towards healthy eating in autism. *Journal of Human Nutrition and Dietetics, 11*, 501-509.
- Dawson, J. E., Piazza, C. C., Sevin, B. M., Gulotta, C. S., Lerman, D., &

- Kelley, M. L. (2003). Use of the high-probability instructional sequence and escape extinction in a child with food refusal. *Journal of Applied Behavior Analysis, 36*, 105-108.
- Emond, A., Emmett, P., Steer, C., & Golding, J. (2010). Feeding symptoms, dietary patterns, and growth in young children with autism spectrum disorders. *Pediatrics, 126*, 337-342.
- Gentry, J. A., & Luiselli, J. K. (2008). Treating a child's selective eating through parent implemented feeding intervention in the home setting. *Journal of Developmental and Physical Disabilities, 20*, 63-70.
- Hartmann, D. P., & Hall, R. V. (1976). The changing criterion design. *Journal of Applied Behavior Analysis, 9*, 527-532.
- Johnson, C. R., Handen, B. L., Mayer-Costa, M., & Sacco, K. (2008). Eating habits and dietary status in young children with autism. *Journal of Developmental and Physical Disabilities, 20*, 437-448.
- Kern, L., & Marder, T. J. (1996). A comparison of simultaneous and delayed reinforcement as treatments for food selectivity. *Journal of Applied Behavior Analysis, 29*, 243-246.
- Ledford, J. R., & Gast, D. L. (2006). Feeding problems in children with autism spectrum disorders: A review. *Focus on Autism and Other Developmental Disabilities, 21*, 156-166.
- Luiselli, J. K. (1988). Improvement of feeding skills in multihandicapped children through pace-prompting interventions. *Journal of the Multihandicapped Person, 1*, 17-30.
- Luiselli, J. K. (2000). Cueing, demand fading, and positive reinforcement to establish self-feeding and oral consumption in a child with chronic food refusal. *Behavior Modification, 24*, 348-358.
- Luiselli, J. K. (2006). Pediatric feeding disorders. In J. K. Luiselli (Ed.), *Antecedent assessment and intervention: Supporting children and adults with developmental disabilities in community settings* (pp. 165-185). Baltimore, MD: Brookes.
- Luiselli, J. K., & Gleason, D. L. (1987). Combining sensory reinforcement and texture fading procedures to overcome chronic food refusal. *Journal of Behavior Therapy and Experimental Psychiatry, 18*, 149-155.
- Luiselli, J. K., Ricciardi, J. N., & Gilligan, K. (2005). Liquid fading to establish milk consumption by a child with autism. *Behavioral Intervention, 20*, 155-163.
- Martens, B. K., Witt, J. C., Elliott, S. N., & Darveaux, D. X. (1985). Teacher judgments concerning the acceptability of school-

based interventions. *Professional Psychology: Research & Practice*, 16, 191-198.

- Mueller, M. M., Piazza, C. C., Moore, J. W., Kelley, M. E., Bethke, S. A., Pruett, A. E., Oberdoff, A., & Layer, S. A. (2003). Training parents to implement pediatric feeding protocols. *Journal of Applied Behavior Analysis*, 36, 545-562.
- Najdowski, A. C., Wallace, M. D., Doney, J. K., & Ghezzi, P. M. (2003). Parental assessment and treatment of food selectivity in natural settings. *Journal of Applied Behavior Analysis*, 36, 383-386.
- Najdowski, A. C., Wallace, M. D., Penrod, B., Tarbox, J., Reagon, K., & Higbee, T. S. (2008). Care-giver conducted experimental functional analyses of inappropriate mealtime behavior. *Journal of Applied Behavior Analysis*, 41, 459-465.
- Piazza, C. C., Patel, M. R., Gulotta, C. S., Sevin, B. M., & Layer, S. (2003). On the relative contributions of positive reinforcement and escape extinction in the treatment of food refusal. *Journal of Applied Behavior Analysis*, 36, 309-324.
- Riordan, M. M., Iwata, B. A., Wohl, M. K., & Finney, J. W. (1980). Behavioral treatment of food refusal and selectivity in developmentally disabled children. *Applied Research in Mental Retardation*, 1, 95-112.
- Tarbox, J., Schiff, A., & Najdowski, A. C. (2010). Parent-implemented procedural modification of escape extinction in the treatment of food selectivity in a young child with autism. *Education and Treatment of Children*, 33, 223-234.
- Tiger, J. H., & Hanley, G. P. (2006). Using reinforcer pairing and fading to increase the milk consumption of a preschool child. *Journal of Applied Behavior Analysis*, 39, 399-403.
- Von Brock, M. B., & Elliott, S. N. (1987). Influence of treatment effectiveness information on the acceptability of classroom interventions. *Journal of School Psychology*, 25, 131-144.
- Werle, M. A., Murphy, T. B., & Budd, K. S. (1993). Treating chronic food refusal in young children: Home-based parent training. *Journal of Applied Behavior Analysis*, 26, 421-433.
- Williams, K. E., & Foxx, R. E. (2007). *Treating eating problems of children with autism spectrum disorders and developmental disabilities*. Austin, TX: Pro-Ed.