

*USING NEGATIVE REINFORCEMENT TO INCREASE SELF-FEEDING
IN A CHILD WITH FOOD SELECTIVITY*

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We examined the effects of a negative reinforcement-based treatment on the self-feeding of 1 child with food selectivity by type and texture. Self-feeding increased when the child could choose to either self-feed 1 bite of a target food or be fed 1 bite of the target food and 5 bites of another food. Possible mechanisms that underlie the effectiveness of the intervention and implications for future research are discussed.

Key words: feeding disorder, food acceptance, food selectivity, negative reinforcement, pediatric feeding disorders, self-feeding

Most typically eating children acquire feeding skills in a sequence that is relatively predictable and culminates in the child feeding him- or herself. Parents promote this progression by offering the child opportunities to self-feed, first with finger foods and ultimately with utensils. In children with feeding problems, this progression may not occur, even when the appropriate opportunities to self-feed are present. One reason why children with feeding problems may fail to progress through the typical developmental sequence of feeding behavior is that they lack the motivation to eat. In fact, children with feeding problems are likely to exhibit escape-maintained behavior (e.g., Bachmeyer et al., 2009; Piazza et al., 2003) that may interfere with the development of age-typical feeding skills (e.g., self-feeding). Therefore, it is not surprising that the results of many studies on feeding problems have suggested that treatments based on negative reinforcement are effective. However, no studies to our knowledge have used negative reinforcement-based procedures to increase self-feeding in children with feeding problems.

One possible method of using negative reinforcement to treat feeding problems (e.g., refusal to self-feed) is to manipulate the parameters of reinforcement along various dimensions (e.g., magnitude, quality, rate, response effort; Athens & Vollmer, 2010). For example, Kerwin, Ahearn, Eicher, and Burd (1995) demonstrated that response-effort manipulations in the form of volume of food on a spoon affected acceptance of food. Kelley, Piazza, Fisher, and Oberdorff (2003) altered the quality of the consequences for acceptance of liquids during three conditions in which consumption of liquids resulted in (a) presentation of a preferred food (positive reinforcement), (b) avoidance of a nonpreferred food (negative reinforcement), or (c) presentation of a preferred food and avoidance of a nonpreferred food. Results of Kerwin et al. and Kelley et al. suggest that manipulations of response effort and quality of reinforcement may be viable treatment options for feeding problems and should be investigated further. In the current study, we manipulated the consequences associated with self-feeding relative to those associated with being fed along the dimensions of response effort (the number of bites the feeder presented to the child vs. the number of bites the child self-fed) and quality (the child's preference for the food). The negative reinforcement manipulation consisted of giving the

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child the opportunity to self-feed one bite of a target food to avoid being fed one bite of the target food plus five bites of another food (hereafter termed the *avoidance food*). We chose these particular manipulations with the child in this study because previous treatments with different response effort and quality manipulations with the Nuk (e.g., one target food to one avoidance food on the Nuk, one target food to five target foods on the Nuk) had not been effective for increasing his self-feeding.

METHOD

Participant, Setting, and Materials

Jerod, a typically developing 6-year-old boy, had been admitted to a pediatric feeding disorders outpatient program for treatment of food selectivity by type and texture. He had no significant medical history or related diagnoses. Jerod obtained 100% of his calories from and fed himself Stage 2 baby foods and milk and a few preferred table-texture foods (e.g., soy nuts, granola bars), but refused to consume or self-feed any other types or textures of foods. He had the skills and the ability to self-feed and to chew and swallow table-texture food based on an evaluation by a speech therapist. Sessions were conducted in a room with one-way observation, which contained a table, a chair with arms, large Maroon spoons, bowls, and a Nuk brush.

Dependent Variables and Interobserver Agreement

Trained observers scored *acceptance*, defined as Jerod using a spoon or his fingers to deposit the bite of food into his mouth within 5 s of presentation. Presentation occurred when the feeder placed the bowl of food in front of Jerod. Observers collected data on laptop computers. Data on acceptance were converted to a percentage after dividing the number of acceptances by the total number of bites presented in each session. A second observer simultaneously but independently scored a mean of 22% of sessions. Interobserver agree-

ment was calculated by summing occurrence and nonoccurrence agreements; dividing by the sum of occurrence agreements, nonoccurrence agreements, and disagreements; and converting this ratio to a percentage. Mean interobserver agreement was 98% (range, 87% to 100%).

Design and Procedure

Design. We evaluated the effects of the avoidance procedure on acceptance of three target foods in individual ABAB designs. The A phase was baseline, and the B phase was the avoidance procedure.

Identification of target and avoidance foods. In the current investigation, we present data on Jerod's acceptance of three table-texture target foods: apples, oatmeal, and oranges. The avoidance foods were pureed peas during treatment with apples and table-texture peanut butter and jelly sandwich during treatment with oatmeal and oranges. The method for selecting these avoidance foods is described below.

Prior to this assessment, we increased Jerod's consumption of pureed foods and then began pilot work on our self-feeding avoidance assessment. We conducted a paired-choice preference assessment (Fisher *et al.*, 1992) to identify oatmeal as least preferred of the pureed foods. We presented pureed oatmeal as the avoidance food using the procedures described below. During the course of the pilot, acceptance of pureed peas did not increase when we used pureed oatmeal as the avoidance food. Therefore, we used pureed peas as the first avoidance food during the current study.

During the current analysis, we used pureed peas as the avoidance food, which increased acceptance of table-texture apples but did not increase acceptance of table-texture peanut butter and jelly sandwich (see results below). Therefore, we used table-texture peanut butter and jelly sandwich as the avoidance food to increase acceptance of table-texture oatmeal and oranges.

General procedure. Across all conditions, the therapist conducted approximately six to eight

sessions in each weekly 1-hr appointment. The therapist explained the session contingencies to Jerod prior to the start of the appointment and explained the contingencies again during the appointment only if they changed. A session consisted of one bite of a single target food (e.g., apples) presented in a bowl once every 30 s for a total of four bite presentations. The bite size was one piece of apple or orange (0.62 cm by 0.62 cm) or one level large Maroon spoonful of oatmeal. If Jerod accepted the bite, the therapist said, "Good job taking your bite."

Baseline. The therapist reviewed the session contingencies, stating, "I'm going to put a bite of food in a bowl in front of you and say, 'take a bite.' If you feed yourself the bite right away, I'm going to say 'Good job taking your bite.'" If Jerod did not accept the bite within 30 s of presentation, the therapist removed the bite and presented the next bite. The therapist would have provided no differential consequences for expulsion, which never occurred.

Avoidance treatment. The therapist reviewed the session contingencies, stating, "If you don't take the bite by yourself, I will feed you a bite of 'target food' [the therapist named the food] and five bites of 'avoidance food' [the therapist named the food] with the Nuk." If Jerod did not accept the target bite within 5 s, the therapist used a Nuk to feed Jerod the bite of the target food followed by five sequentially fed bites of the avoidance food. The bolus size of the avoidance food was half of a level large Maroon spoon of pureed peas or a piece of peanut butter and jelly sandwich (0.62 cm by 0.62 cm). The therapist inserted the Nuk into Jerod's mouth to deposit the bite unless he willingly opened his mouth to allow the bite to be deposited, which he typically did. By positioning the Nuk at the side of Jerod's mouth between his teeth and gums near his molars and rotating it, the therapist could deposit the bite even if he refused to open his mouth. The therapist did not press the Nuk down on his tongue when depositing the bite.

The therapist re-presented expelled bites with the Nuk.

Parent training. After we demonstrated the effectiveness of the treatment, we trained Jerod's mother using written and verbal instructions, role play, modeling, and feedback. His mother reported that Jerod began eating table-texture apples independently at home after treatment; therefore, we did not train his mother on treatment with apples.

RESULTS AND DISCUSSION

During baseline, mean acceptance (Figure 1) was zero but increased to high levels during the avoidance treatment for apples ($M = 100\%$). These results were replicated during the reversal to baseline and return to treatment. During baseline, mean acceptance was zero and remained at zero during the avoidance treatment for peanut butter and jelly sandwich (data not shown). Pureed peas were not effective as the avoidance food. During the initial baseline, mean acceptance (Figure 1) was zero for oatmeal and 25% for oranges (range, 0% to 100%). During the avoidance treatment, acceptance increased to high and stable levels for both foods ($M = 100\%$). When we removed the avoidance treatment, acceptance declined to low levels for oatmeal ($M = 14\%$; range, 0% to 75%) and oranges ($M = 0\%$). When we reintroduced the avoidance treatment, acceptance again increased to high and stable levels for oatmeal ($M = 100\%$) and oranges ($M = 100\%$). Acceptance remained high for oatmeal ($M = 95\%$; range, 75% to 100%) and oranges ($M = 100\%$) during parent training.

In the current study's choice arrangement, the consequences for self-feeding were presumably more favorable than the consequences for being fed. The response-effort manipulation was that self-feeding was associated with consumption of a single bite of food and being fed was associated with consumption of six bites of food, which was presumably more effortful because the larger volume of food required more

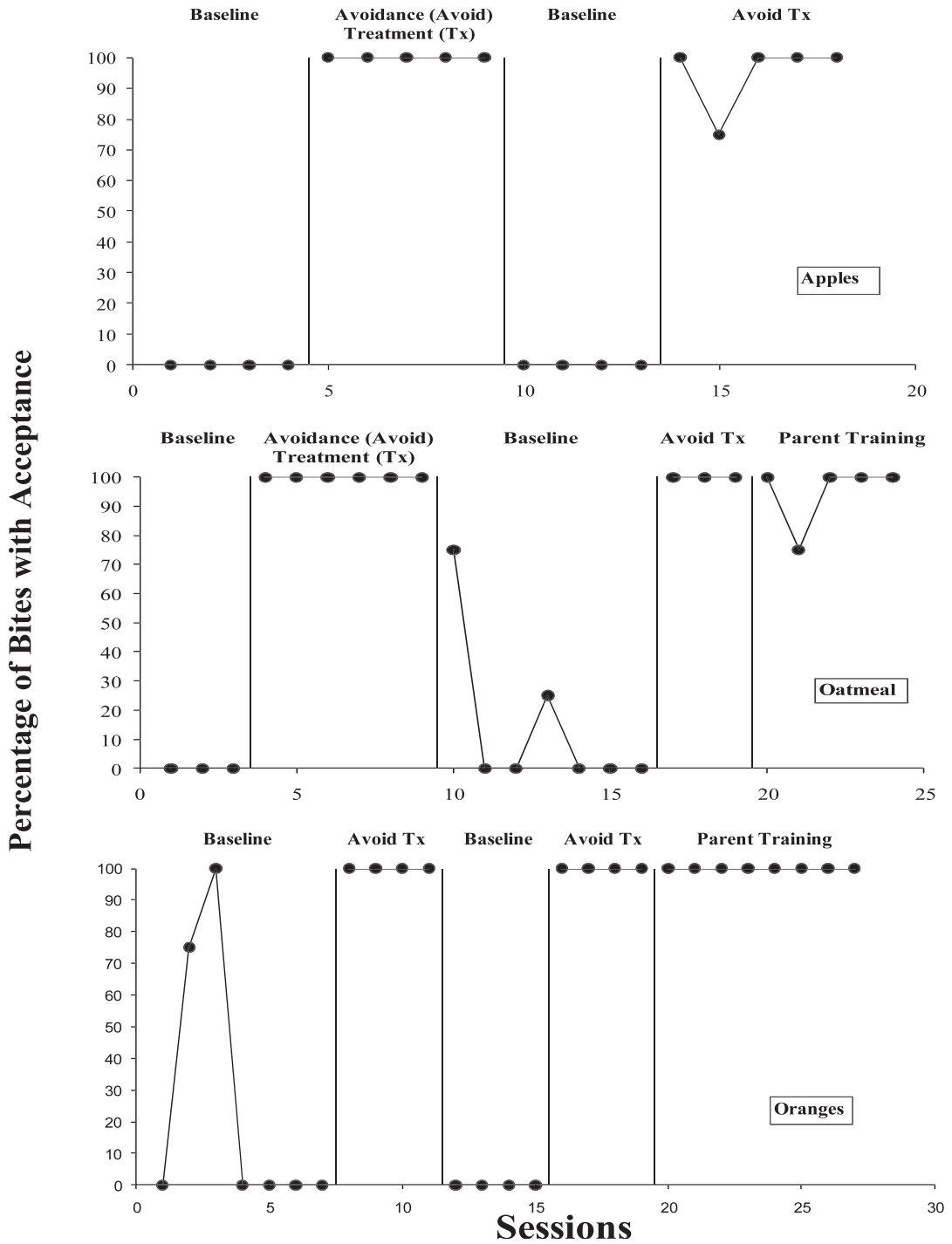


Figure 1. Percentage of bites with acceptance for apples (target food, top) with pureed peas as the avoidance food and for oatmeal (target food, middle) and oranges (target food, bottom) with table-texture peanut butter and jelly sandwich as the avoidance food.

chewing and oral manipulation to consume. We assumed that the avoidance food was less preferred than the target food based on Jerod's response to the foods when they were presented during the avoidance assessment (i.e., he consumed the target food more often than the avoidance food). Therefore, the qualitative manipulation was that self-feeding was associated with consumption of the more preferred target foods and being fed was associated with the less preferred avoidance foods. Although these manipulations were effective in increasing Jerod's self-feeding, the obvious limitation is that we did not demonstrate whether both the response effort and quality manipulations were necessary. In addition, if response effort was an active treatment component, it is not clear how much effort must be manipulated to increase self-feeding (e.g., could we have increased the ratio of self-fed to non-self-fed bites to 1:2, 1:3, or 1:4 and still have achieved an effect?). Future investigations should evaluate the individual contributions of response effort and quality manipulations and evaluate the extent of the response-effort manipulation necessary to increase self-feeding.

An alternative explanation for these findings is that Jerod's increase in self-feeding was a function of avoidance of the Nuk rather than the target- and avoidance-food manipulations. Recall that the therapist fed the target and avoidance foods with the Nuk. By contrast, Jerod fed himself with the spoon. We did not test the Nuk alone; therefore, future investigations could test the effects of allowing a child to self-feed with a spoon versus feeding the child with a Nuk without the target- and avoidance-food manipulations. Future investigations also could evaluate presentation of target and avoidance foods with and without a Nuk.

One interesting finding was that Jerod's acceptance increased to 100% immediately in the first treatment phase for all foods except the peanut butter and jelly sandwich, and he only contacted the avoidance contingency twice. He had been exposed to the avoidance treatment

with pureed foods already; therefore, the immediate increase in acceptance may have been a function of rule-governed behavior that developed during our pilot work with pureed foods. Recall that we explained the contingencies to him prior to the beginning of the appointment.

A second interesting finding was that Jerod's food preferences appeared to shift during the study, perhaps as a result of repeated exposure (Mueller, Piazza, Patel, Kelley, & Pruett, 2004). We conducted a paired-choice preference assessment in which we identified pureed oatmeal as the least preferred food. Recall that during the course of our pilot work, acceptance of pureed peas did not increase when pureed oatmeal was the avoidance food, possibly indicating that pureed peas became less preferred than pureed oatmeal. Furthermore, acceptance of table-texture peanut butter and jelly sandwich did not increase when pureed peas was the avoidance food, possibly indicating that table-texture peanut butter and jelly sandwich became less preferred than pureed peas. Future studies should conduct ongoing preference assessments to evaluate the extent to which preferences for foods change over time (Hanley, Iwata, & Roscoe, 2006).

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