A COMPONENT ANALYSIS OF A TREATMENT PACKAGE
TO INCREASE NOVEL FOOD ACCEPTANCE
IN A BOY DIAGNOSED WITH ASD

A Thesis Presented to the Faculty
of
California State University, Stanislaus

In Partial Fulfillment
of the Requirements for the Degree
of Master of Arts in Psychology

By
Jennifer Black
May 2018
CERTIFICATION OF APPROVAL

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DEDICATION

To my mother, who inspires me to be better every day.
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedication</td>
<td>iv</td>
</tr>
<tr>
<td>List of Figures</td>
<td>vii</td>
</tr>
<tr>
<td>Abstract</td>
<td>viii</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Definition and Measurement of Food Selectivity</td>
<td>2</td>
</tr>
<tr>
<td>Antecedent- and Consequence-Based Interventions</td>
<td>3</td>
</tr>
<tr>
<td>Observational Learning</td>
<td>4</td>
</tr>
<tr>
<td>Current Study</td>
<td>8</td>
</tr>
<tr>
<td>Methods</td>
<td>9</td>
</tr>
<tr>
<td>Setting and Participants</td>
<td>9</td>
</tr>
<tr>
<td>Dependent and Independent Variables</td>
<td>10</td>
</tr>
<tr>
<td>Data Collection and Interobserver Agreement</td>
<td>11</td>
</tr>
<tr>
<td>Assessments and Measures</td>
<td>12</td>
</tr>
<tr>
<td>Procedure</td>
<td>13</td>
</tr>
<tr>
<td>Experimental Design</td>
<td>16</td>
</tr>
<tr>
<td>Maintenance and Generalization</td>
<td>17</td>
</tr>
<tr>
<td>Results</td>
<td>18</td>
</tr>
<tr>
<td>Discussion</td>
<td>24</td>
</tr>
<tr>
<td>Limitations</td>
<td>26</td>
</tr>
<tr>
<td>Future Research</td>
<td>27</td>
</tr>
<tr>
<td>Conclusion</td>
<td>28</td>
</tr>
<tr>
<td>References</td>
<td>30</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
</tr>
<tr>
<td>A. Recruitment Flyer</td>
<td>36</td>
</tr>
<tr>
<td>B. Parental Informed Consent</td>
<td>37</td>
</tr>
<tr>
<td>C. Parental Informed Consent – Peer Helper</td>
<td>39</td>
</tr>
</tbody>
</table>
D. Data Collection – All Conditions................................................................. 41
E. Parent Survey ............................................................................................. 42
F. Procedural Integrity - Baseline ................................................................. 43
G. Procedural Integrity – Condition A: Differential Reinforcement .......... 44
H. Procedural Integrity – Condition B: Peer Modeling.............................. 45
I. Procedural Integrity – Condition C: Peer Modeling + Differential
   Reinforcement............................................................................................. 46
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Acceptance of Carrots</td>
<td>19</td>
</tr>
<tr>
<td>2. IMB - Carrots</td>
<td>20</td>
</tr>
<tr>
<td>3. Acceptance of Yogurt (Partial and Full Acceptance)</td>
<td>21</td>
</tr>
<tr>
<td>4. IMB - Yogurt</td>
<td>22</td>
</tr>
<tr>
<td>5. Acceptance of Banana</td>
<td>23</td>
</tr>
<tr>
<td>6. IMB - Banana</td>
<td>23</td>
</tr>
</tbody>
</table>
ABSTRACT

Feeding problems are common throughout the development of children. However, children diagnosed with autism spectrum disorder (ASD) are at a higher risk for feeding issues, including food refusal and food selectivity. The current study investigated the effectiveness of a two-component treatment package of peer modeling and differential reinforcement to increase acceptance of novel foods. Each component was evaluated in isolation and in combination. Previous research suggests differential reinforcement and modeling can be effective in increasing consumption, but there have been few studies looking at the components in isolation and the results have been inconsistent. A 3-year-old boy diagnosed with ASD was selected to increase acceptance of three foods not present in his diet. He was exposed to four conditions throughout the study: baseline, differential reinforcement, peer modeling, and a treatment package of peer modeling and differential reinforcement. Results showed acceptance of a banana remained at zero, acceptance of carrots increased to 100% across all conditions, and acceptance of yogurt highest across differential reinforcement and the treatment package. These results correspond with previous research showing inconsistent results and combining modeling and differential reinforcement can be as effective as the components in isolation. Unlike prior research, the treatment package was not required to increase acceptance, and differential reinforcement was equally as effective for two of the three foods presented. In order to evaluate the most effective intervention for increasing acceptance of foods not presently in children’s diets, future research is still required.
INTRODUCTION

Feeding problems are common throughout the development of most children. However, individuals with autism spectrum disorder (ASD) are at a higher risk for feeding issues that include food refusal and food selectivity (American Psychiatric Association, 2013). Typically, young children have limited food preferences and display food neophobia, or the hesitancy to eat novel foods (Addessi, Galloway, Visalberghi, & Birch, 2005; Barnett, 1963 as cited in Addessi, Galloway, Visalverghi, & Birch, 2005). It is also common to find a higher prevalence of neophobia in children 2 to 5 years old than in infants 4 to 7 months old.

Food neophobia may be viewed as a survival tool during the ages of 2 to 5 years old. From an evolutionary standpoint, an omnivore’s caution towards novel foods functions to protect it from ingesting poisonous substances. However, this may also have harmful implications if food preferences become too restricted (Rozin, 1977 as cited in Addessi et al., 2005). Likewise, children who display food neophobia may develop food selectivity, which can lead to inadequate nutritional intake (Bandini et al., 2010). In addition, food selectivity can be associated with inappropriate mealtime behavior (Bachmeyer & Piazza, 2009; Levin & Carr, 2001), parental stress (Postorino et al., 2015), and restrictions on what the rest of the family eats (Curtin et al., 2015).

In past years, research has grown for treating food selectivity for individuals with developmental disabilities, specifically children diagnosed with ASD. Part of the criteria for an individual to receive a diagnosis of autism is having restrictive,
repetitive behavior that often includes being inflexible with changes in routine and insistence on sameness (American Psychiatric Association, 2013). This is often seen in the diet of individuals diagnosed with ASD. To exemplify, Schrek, Williams, and Smith (2004) used caregiver reports to compare the eating habits of children with ASD to typically developing children (ranging from 5 to 12 years old). Results of the study showed that children with ASD had significantly higher feeding problems and a narrower range of foods. Further, Ahearn, Castine, Nault, and Green (2001) assessed food acceptance in children diagnosed with ASD and pervasive developmental disorder-not otherwise specified (PDD-NOS), ranging from 3 to 14 years old. Researchers found that more than half of the 30 participants exhibited food selectivity by demonstrating low levels of food acceptance across category or texture. With high levels of food selectivity shown in research for this population, additional research on interventions continues to be an important area of focus.

**Definition and Measurement of Food Selectivity**

Throughout the literature on eating and feeding problems, there have been various conceptualizations and definitions of food selectivity. Food selectivity has been defined as choosing only a limited number of foods to be consumed or consuming an inadequate variety of foods (Lukens & Linscheid, 2008), consumption of a narrow, nutritionally inadequate diet (Field, Garland, & Williams, 2003), and rejecting most novel foods (Levin & Carr, 2001). More recently, Bandini et al. (2010) developed a definition of food selectivity by dividing it into three separate domains: (a) food refusal, (b) limited food repertoire, and (c) high-frequency single food intake.
(HFSFI). Although these definitions have contributed to the conceptualization of food selectivity, Penrod, Wallace, Reagon, Betz, and Higbee (2010) used an objective and measurable definition. Specifically, criteria for food selectivity was defined as “eating less than five foods (not including snacks or sweets) and refusing foods from at least one of the food groups of fruit, starch, protein, and vegetable.”

**Antecedent- and Consequence-Based Interventions**

**Antecedent-Based Interventions**

Many antecedent- and consequence-based interventions have been used, both in isolation and together, to increase consumption of foods not present in children’s diets. With antecedent-based interventions, there has been much success with increasing food consumption of foods not currently in a child’s diet. Antecedent-based interventions include sequential presentation (e.g., Pizzo, Coyle, Seiverling, & Williams, 2012), simultaneous presentation (e.g., Ahearn, 2003), stimulus fading (e.g., Levin & Carr, 2001), high-probability instructional sequence (e.g., Patel et al., 2007; Penrod, Gardella, & Fernand, 2012), choice (e.g., Fernand, Penrod, Fu, Whelan, & Medved, 2016), and modeling (e.g., Fu et al., 2015).

**Consequence-Based Interventions**

In addition to the various antecedent-based interventions, research has also looked at consequence-based interventions. Throughout the literature on treating food selectivity, one of the most cited consequence-based interventions has been escape extinction (EE). This procedure is typically employed by not allowing the individual to leave the meal until he or she has consumed the required amount of food. This
often consists of keeping a food or a beverage on a spoon within very close proximity to the individual’s mouth (e.g., within one inch) until accepted. Many studies have shown that this is a critical component of treatment packages employing multiple interventions (e.g., Dawson et al., 2003; Penrod et al., 2010; Najdowski et al., 2010).

Although research shows EE to be an effective treatment to increase consumption of foods not previously eaten, there are many reasons to use alternative interventions. For example, many side effects can occur when extinction is employed (Lerman & Iwata, 1996). Extinction bursts (i.e., where problem behaviors may increase temporarily), and emotional or aggressive responding may occur (Miltenberger, 2008). These side effects make it difficult for family members to implement EE in natural settings. Thus, it is difficult to maintain behavior change and generalize it from the treatment setting to the home or community.

**Observational Learning**

Observational learning, as applied to the treatment of feeding problems, has been an area of interest for some behavior analysts. For example, Addessi et al. (2005) investigated social influences on the acceptance of novel foods in typically developing children between the ages of 2 to 5 years old. They tested 27 children under three conditions: a familiar adult being present, the adult modeling eating a food of a different color and flavor, and the adult model eating a food of the same color and flavor. Results indicated that children were more likely to eat novel foods if there was a model eating the same type of food, versus a model eating a different type of food or merely being present during the meal.
Fu et al. (2015) compared modeling, modeling with differential reinforcement, and modeling with differential reinforcement and non-removal of the spoon with two children diagnosed with autism. This study showed success for one participant when using modeling with differential reinforcement, while the other participant required non-removal of the spoon to increase his acceptance of the various foods presented. Neither participant accepted food when presented with modeling only. This may have been due to the use of an adult model rather than a similar peer. Also, modeling alone may have been ineffective because it was delayed. Modeling did not begin until after 5 s elapsed where the participant did not independently accept the food or engage in food-approaching behavior (e.g., picking up the food).

Past studies used sequential component analyses to determine the effectiveness of EE and differential reinforcement. These were conducted by comparing the effect of individual components of a treatment package to the overall treatment package itself (Patel, Piazza, Martinez, Volkert, & Santana, 2002; Piazza, Patel, Gulotta, Sevin, & Layer, 2003). These studies did not find differential positive reinforcement to be effective at increasing acceptance of foods not presently in the children’s food repertoires. However, it is important to note that Patel et al.’s study (2002) used verbal praise and access to toys as differential reinforcement but did not specify how they determined these toys or praise as true reinforcers for the participants. EE was a necessary component in this study to demonstrate consistent acceptance of the foods and drinks presented. In addition, Piazza et al. (2003) included participants with food refusal, who rarely earned the reinforcer (e.g.,
preferred toys, attention) for acceptance of novel foods. The contingency of earning the reinforcement for eating the food may not have been established with the participants due to not ever being successful with accepting the food. Those studies’ findings may have been affected by these limitations and additional research is needed on differential reinforcement used in isolation.

Conversely, Werle, Murphy, and Budd (1993) conducted a study involving parent training to use differential reinforcement, specifically targeting the provision of attention for three young children. Reinforcement was provided for consumption of foods refused during baseline, and another phase targeted increasing independence with eating. Parents were taught to use verbal and physical praise and other rewards (e.g., preferred foods, interactive games) contingent on their child eating the previously refused foods and disruptive behaviors were ignored. Food expulsion and attempting to leave the table were followed by a form of EE of saying “no” in a firm voice and physically blocking the child from attempting to leave the meal area. Two out of the three sets of parents were taught a brief time-out procedure involving turning the child’s chair away from the table for 30–60 s and withholding attention to interrupt continued disruptive behavior. Consumption of foods increased for all participants, but this does not assess differential reinforcement alone. These inconsistencies indicate a need for future research focusing on the effects of differential reinforcement in isolation.

In another study, Greer, Dorow, Williams, McCorkle, and Asnes (1991) demonstrated the efficacy of using differential reinforcement with a peer model in
two studies. These studies were successful in inducing swallowing by a child who had not previously swallowed food or liquid, and increasing food consumption in a child who consistently declined food. For the study with the child who consistently declined food, there were two phases of intervention involving peers. For one condition, the trainer alternated between presenting the peer with the food or drink and then the same to the participant, then provided verbal praise to the peer and participant after consumption. For the other condition, the trainer presented the model and the participant with the food or drink at the same time, in which they could both eat and receive verbal praise for consumption. This study employed a multiple treatment reversal design with three phases with food alternating between peer and participant and verbal praise for acceptance of the food or drink, and one phase where the peer and participant were presented the food or drink at the same time and opportunities for verbal praise. During the two baseline phases before the intervention was employed, the participant accepted an average of 35% of bite presentations. Results showed higher success of acceptance with the phase alternating between peer and participant than the condition where food was presented to the peer and the participant simultaneously, with an average of 72% of presentations in comparison with 50% of presentations, respectively.

Sira and Fryling (2012) also demonstrated the efficacy of a treatment package consisting of differential reinforcement of preferred tangible items and edibles with a model for a boy diagnosed with autism. This extended the Greer et al. (1991) study by involving family members as the model and therapist giving the instructions and
explaining the contingencies to the participant in the home setting, a less structured environment than the treatment facility. Specifically, the participant observed his sibling take bites of a novel food, and then receive immediate reinforcement (i.e., checkmarks exchanged for preferred edibles, beverages, and activities). After the model received reinforcement for consuming the food, the participant was instructed to take a bite across 10 bite presentations. Sessions occurred 1 to 2 times per week, with each phase having 3 to 5 sessions that demonstrated a stable trend. Results from the study indicate that the treatment package was an effective way to increase the variety of foods consumed, with the participant accepting all three foods after exposure to the intervention. Additional research continues to analyze what components and treatment packages are effective at increasing acceptance of foods not presently in children.

**Current Study**

The current study will examine the effects of a two-component treatment package consisting of peer modeling and differential reinforcement, in addition to looking at each component in isolation, to increase the acceptance of novel foods not presently in a 3-year-old’s diet.

*Hypothesis:* The individual components will be equally effective, and the treatment package as a whole will be the most effective in increasing consumption of the target foods and having the lowest rates of IMB when target foods are presented.
METHODS

Setting and Participants

The study was conducted at a non-public agency that provides intensive applied behavior analytic (ABA) therapy to children diagnosed with autism spectrum disorder. To participate in this study, children were required to meet the inclusion criteria for having food selectivity, modified from Penrod et al. (2010): (a) eating a minimum of two foods but less than eight foods (not including snacks or sweets), (b) refusing foods from at least one of the food groups of fruit, starch, protein, and vegetable, and (c) having minimal prior exposure to food programs that were not effective in increasing the child’s food repertoire or having no prior exposure to food programs.

Two children were recruited from the Kendall Center in Tracy, California, through a flyer distributed to clinicians [Appendix A]. One participant only participated in one session, then was removed from the study per the child’s treatment team’s request based on increasing problem behavior outside of the study. A 3-year-old boy named Jordan (who turned age 4 between sessions 12 and 13 during the study) completed the current study. He was diagnosed with ASD at the age of 29 months and had received intensive applied behavior analysis services since the age of 28 months. He had no previous exposure to food programs designed to increase the number of foods in his diet.
Dependent and Independent Variables

Data were collected via direct observation by the main researcher or a trained research assistant. Dependent measures were the number of bites consumed and number of presentations of food where inappropriate mealtime behavior (IMB) was displayed. Consumption of bites (acceptance) was defined as the participant independently picking up the food with his fingers or a utensil, placing the food into his mouth, chewing the bite by opening and closing his mouth with the food on his teeth, and swallowing the entire bite with the absence of expulsion or regurgitation. In addition, partial acceptance was defined as the same as acceptance, but swallowing less than the entire bite. Using a similar definition as Sira and Fryling (2012), IMB was defined as verbal refusals (saying “no”), negative comments (saying something negative about the food), crying (with tears present), pushing or throwing food or utensils (more than 3 inches in a direction away from the participant), gagging (“retching or choking sounds”), and vomiting (“regurgitation of previously swallowed food”).

The independent variables involved the treatment components: differential reinforcement for acceptance (i.e. praise, tangible or preferred edible; putting IMB on extinction), peer model eating the target food, and the treatment package combining differential reinforcement with a peer model. Baseline data were also collected throughout the study as another condition by presenting the bites of food with no antecedent or consequence manipulations.
Data Collection and Interobserver Agreement

The researcher or research assistant collected data on the number of bites consumed when presented with 10 bites of the non-preferred food, presented one at a time, then converted to a percentage. This was recorded on a datasheet created for this study [Appendix D] and calculated by dividing the number of bites consumed by the total number of bites presented and multiplied by 100%.

IMB was collected by circling “IMB” on the datasheet, opposed to “NO IMB.” Due to the short duration of IMB (e.g., pushing plate away from him), duration of IMB was not collected, but rather if IMB occurred or not and its topography. During all phases of treatment, the food remained in front of the participant for 10 s before removal, regardless of engaging in IMB or not. Percentage of food presentations where IMB was displayed was calculated by dividing the number of food presentations where IMB was displayed by the total number of food presentations and multiplied by 100.

Interobserver agreement (IOA) was collected by the researcher and research assistant for acceptance of foods and IMB displayed, taking data on the same session. This was collected for an average of 50% of sessions for all foods, with 40% of sessions for differential reinforcement conditions and peer modeling conditions, and 60% of sessions for baseline conditions and treatment package conditions. IOA was calculated by dividing the total number of agreements by the total number of agreements and disagreements and multiplied by 100%. IOA totaled 99% agreement for acceptance of foods, with agreement for carrots, banana, and yogurt at 100%.
100%, and 97%, respectively. IOA totaled 99% agreement for IMB during sessions, with agreement for carrots, banana, and yogurt at 100%, 99%, and 99%, respectively. During every session, the researcher or research assistant used a checklist relevant to the current condition for that day according to the alternating treatment design. This increased the likelihood procedures within each condition were accurately conducted each session for treatment integrity, with a different datasheet per condition [Appendix E-H].

**Assessments and Measures**

Parents/guardians of potential participants were given a consent form that described the procedure and outlined the potential risks and benefits expected from participation in the current study [Appendix B]. Upon giving consent, the parents/guardians were asked to provide a list of all foods the child eats, 10 foods the family eats that the child does not accept, and a list of a minimum of four highly preferred edibles or tangible items or activities. In addition, guardians for the peer helpers were also given a consent form, containing similar risks and benefits for the peer’s participation [Appendix C].

Jordan’s guardian reported the 10 foods in his diet, consisting of chocolate chip Chewy brand granola bars, chocolate chip cookies, M&M’s, graham crackers, Cheerio’s, french fries, popcorn, grilled cheese sandwiches, chicken nuggets, apples, string cheese, and waffles, totaling seven foods in his diet that were not considered “snacks/sweets” (granola bars, cookies, M&M’s, graham crackers and popcorn were considered snacks or sweets). In addition, his guardian listed the foods the family eats
that Jordan did not accept: chicken (besides chicken nuggets), hamburgers, all vegetables, all fruit, pasta, potatoes (besides french fries), eggs, yogurt, rice, and cheese (except on grilled cheese sandwiches). His guardian selected carrots, strawberry yogurt, and bananas to be the target foods.

Four potentially reinforcing items were selected by Jordan’s guardian and from feedback from Jordan’s Clinical Assistant at the Kendall Center. A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) was conducted with the typically highly-preferred items that included videos from YouTube (Minions, Blaze and Monster), chocolate chip cookies, popcorn, and M&M’s. The items were displayed in an array and Jordan selected one item. The array was then presented again with the item previously selected removed from the field, until three highly preferred reinforcers were selected. The three items, chocolate chip cookies, videos, and popcorn, were selected to be provided as reinforcement for the differential reinforcement condition and treatment package condition.

**Procedure**

Prior to beginning baseline sessions, the researcher presented five bites of the three foods, selected by the participant’s guardian, on a plate and told the participant to “take a bite,” presenting the food for one min to verify his non-acceptance. The strawberry yogurt was presented on a spoon, the banana was presented on a fork, and the carrot was presented without a utensil. This was done for each food used in the study with one food presented at a time, verifying the three foods were accepted in
0% of presentations. If a food was accepted during this time, it was not used in the study.

The foods were presented in a consistent manner with the same size or amount presented each trial and presentation. The carrots were approximately 3/4” cubes, yogurt bites were approximately 1/2 teaspoon, and bananas were approximately 1/4” thick round slices.

For all phases, if the participant did not accept the non-preferred food and/or engaged in IMB, the food remained in front of him for 10 s. After 10 s elapsed, the bite was removed from view. Each food had 10 consecutive presentations, with three foods presented, for a total of 30 presentations of food. For two sessions bananas were not brought that day, so only yogurt and carrots were presented. If the participant was to engage in severe IMB, putting himself or another person in danger, such as head banging, the session was terminated. After 10 s of no engagement in IMB, the participant was presented with the next bite. If no IMB occurred, after 10 s of the food being removed, or after the food was swallowed if 10 s had elapsed from when the participant put the bite into his mouth, the next bite was presented of the same food. As previously presented, the banana bites were presented on a fork, yogurt bites presented on a spoon, and carrot bites were presented without a utensil, all on a plate, one bite at a time of each target food individually.

**Baseline Sessions**

During baseline sessions, the participant was presented with a target food and told to “take a bite.” The main researcher or research assistant recorded whether he
accepted the bite and if any IMB occurred when the food was presented for 10 bite presentations per food item. If the participant accepted the food presented, no praise or reinforcement was given, and another bite was presented 10 s later.

**Modeling Sessions (No Differential Reinforcement)**

The four peers used for modeling received training prior to being approved for the study. Training consisted of explaining the contingencies of eating the target food within 3 s of it being presented, then saying a positive comment after putting the food into their mouths to earn a selected reinforcer once the session with the participant ended. This was practiced without the participant to ensure modeling consistency, and mastery was achieved once this was demonstrated at 100% for five consecutive, unprompted practice trials. A rehearsal of the contingency was completed prior to every session (i.e., “Remember, eat the carrots and when we are all done you can get to play video games!”).

For all modeling sessions, the participant sat with the peer model. The model was presented a bite of the target food on a plate, with a utensil if applicable (e.g., banana and yogurt). The model was told to “take a bite.” The model consumed the bite and made a positive comment about the food (e.g., “Mm, that tasted good!”). Next, the participant was told to “take a bite” in the same manner as the model, and no reinforcement in the form of praise or tangible items or edibles was provided.

**Differential Reinforcement Sessions (No Peer Present)**

Prior to starting the session, the therapist brought the three selected reinforcers, determined by the MSWO preference assessment. At the start of every
trial, the selected reinforcers were presented to the participant in a field of three, and the participant chose one of the three items. Next, the participant was then told the rule, “Take a bite, get (reinforcer).” If he selected the videos on YouTube, the participant earned access to the videos for 15 s. If the selected reinforcer was an edible, the edible would be no larger than the target food presented. For the yogurt, if it was partial acceptance, the size of popcorn or cookie was also proportionate to the amount accepted, and videos were reduced to 10 s. Verbal praise was always paired with presenting the tangible reinforcement (e.g., “Nice eating the cookie! You get video!”).

**Treatment Package Sessions (Peer Present and Differential Reinforcement for Acceptance of Bites)**

The treatment package sessions started with the model and the participant sitting down, and the participant selected a reinforcer in the same manner as described in the differential reinforcement phase. The peer was presented the bite of the target food first, consumed the bite, and made a positive comment about the food. The therapist then told the participant “take a bite, get (reinforcer).” Then, the same amount of target food was presented to the participant. The same consequences followed for the participant if he accepted the bite as the differential reinforcement condition.

**Experimental Design**

The present study employed a single-subject, alternating treatment design with alternating treatments across conditions. Every session alternated between the
baseline condition, the peer model condition, the differential reinforcement condition, and the treatment package condition (peer model + differential reinforcement). Each food was exposed to each condition to show potentially varying trends dependent on the condition used. Order of sessions were selected randomly by pulling papers with conditions written on them out of a hat until each condition was selected five times, then it was removed from the selection.

**Maintenance and Generalization**

Three months after treatment sessions ended, both a maintenance check and a generalization probe were conducted. For the maintenance check, sessions were conducted the same as the baseline condition. For the generalization probe, sessions were similar to the baseline condition, with the exception of the presentation of the food and the instruction. For the banana and carrots, all 10 bites were presented at once on a plate, with a fork piercing one of the banana bites. For the yogurt, a cup of the same brand and flavor yogurt was presented on a plate with a spoon in the yogurt. For generalization, the participant was instructed to “eat your (food)” then prompted “take a bite” if 10 s elapsed and he had not yet taken a bite of the food.
RESULTS

Prior to the research being conducted, all foods were found to be at 0% acceptance, verifying the participant’s guardian’s report. The participant was exposed to the target foods of carrots and yogurt for five sessions in each of the four conditions: baseline, peer modeling, differential reinforcement of acceptance, and the treatment package of peer modeling and differential reinforcement, totaling 20 sessions. The participant had 18 sessions with bananas being the targeted food, due to bananas not being brought in for a session of peer modeling and a session of the treatment package.

Figure 1 displays the percentage of acceptance for carrots across all conditions. When analyzing the figure visually, acceptance increased to 90% after the first differential reinforcement condition session, where he accepted 20% of the bites presented. This may be a result of eating the bite and showing preference for the carrots, which went to 100% acceptance at the third session, the first session of the treatment package condition. Following this session, there were only three sessions that were not at 100%, with two sessions’ acceptance at 80% and one session’s acceptance at 90%. The baseline condition had the lowest percentages of acceptance, but all conditions demonstrated success of 80% or higher following the first session of the differential reinforcement condition.
Figure 1. Acceptance of Carrots. Percentage of acceptance of carrots across experimental conditions, with 100% acceptance for maintenance check and generalization at 3-month follow up.

Figure 2 displays only 1 of the 20 sessions the participant demonstrated IMB with carrots, pushing the plate away more than 3 inches away from him for 20% of the 10 presentations.
Figure 2. IMB – Carrots. Percentage of IMB across experimental conditions with presentations of carrot, and 0% IMB for maintenance check and generalization at the 3-month follow up.

Figure 3 displays the percentage of acceptance of yogurt, with both partial and full acceptance represented, due to only one bite in two sessions (total of two bites) being full acceptance of the yogurt on the spoon. Approximately a teaspoon of yogurt on a spoon was presented to the participant across all conditions. In analyzing the graph visually, acceptance in the baseline condition remained at 0% until the fifth presentation (sixth including the pre-study baseline condition), where acceptance increased to 90%. The other three conditions had varying rates of acceptance, with the differential reinforcement condition and the treatment package condition displaying similar trends across each condition’s five sessions. The peer modeling
condition displayed lower, varying levels of acceptance, with a mean of 26% acceptance.

Figure 3. Acceptance of Yogurt (Partial and Full Acceptance). Percentage of acceptance of yogurt across experimental conditions, with 0% acceptance for maintenance check and generalization at 3-month follow up.

Figure 4 depicts the percentage of IMB displayed for each session across the conditions with yogurt presentations. The highest levels of IMB were displayed for the baseline condition and the peer modeling condition. IMB consisted of pushing the plate away, with one occurrence of throwing the yogurt in the direction of the researcher. Overall, the trend did decrease for the percentage of IMB displayed across sessions, with the highest level across baseline sessions. In addition, the percentage of IMB increased to 90% for the maintenance check then decreased to 0% for generalization. When presented a cup of yogurt with a spoon, the participant stirred the spoon in the yogurt, not demonstrating any IMB.
Figure 4. IMB – Yogurt. Percentage of IMB across experimental conditions with presentations of yogurt, with 90% IMB for maintenance check and 0% for generalization at 3-month follow up.

Figure 5 displays the percentage of acceptance of bites of bananas across experimental conditions, which remained at 0% across all conditions. Interestingly, the maintenance check for acceptance of bites of bananas resulted in 70% acceptance of the 10 bites presented, although the generalization probe remained at 0%. Below, Figure 6 depicts the percentage of IMB displayed with presentations of banana across the experimental conditions. This graphic display demonstrates an increasing trend by the fourth session and decreasing with the 10th session across conditions.
**Figure 5.** Acceptance of Banana. Percentage of acceptance of banana across experimental conditions, with 70% acceptance for maintenance check and 0% for generalization at 3-month follow up.

**Figure 6.** IMB – Banana. Percentage of IMB across experimental conditions with presentations of banana, with 0% IMB for maintenance check and 90% IMB for generalization at 3-month follow up.
DISCUSSION

Based on the reviewed research literature, it was hypothesized that the treatment package, as a whole, would have the highest percentage of target food acceptance and the lowest percentage of IMB across sessions. The individual components (peer modeling and differential reinforcement) were hypothesized to be equally effective but at a lower percentage in food acceptance than the treatment package as a whole. Percentage of IMB was expected to be higher in these conditions than the treatment package as a whole. The actual results differed from those hypothesized. Across the three foods, yogurt was the only food to demonstrate variability of acceptance contingent on treatment condition. With yogurt, the highest percentages of acceptance were with the differential reinforcement in isolation condition and the treatment package condition. This varied slightly from what was hypothesized, with slightly higher acceptance in the differential reinforcement in isolation condition over the treatment package condition. In addition, when looking at the three experimental conditions, peer modeling had lower acceptance than differential reinforcement. IMB was present for all conditions, but the lowest rate was in the differential reinforcement in isolation condition. For acceptance of carrots, determining which treatment condition was responsible for increasing acceptance was not possible due to the high percentages of acceptance after the second treatment condition. In addition, the percentages of IMB displayed with presentations of carrots were at 0% across all conditions, except for one session where there was 20% of IMB displayed for the treatment package condition. Acceptance of bananas also did not
show any acceptance except during the maintenance phase. Percentages of IMB were similar for bananas across conditions but decreased over time across all conditions. Previous research also did not have one treatment that was consistently successful across participants or foods. Food texture variability as it relates to food acceptance was explored in prior research (e.g., Najdowski, Tarbox, & Wilke, 2012; Shore, Babbitt, Williams, Coe, & Snyder, 1998). Based on those findings, food texture could have been a factor in the variable results across the three foods used in this study.

The results of the current study are consistent with the findings of Greer et al. (1991) and Sira and Fryling (2012), who also found the treatment package consisting of modeling and differential reinforcement to be effective in increasing a child’s acceptance of foods not presently in his or her diet. In addition, this adds to the behavior analytic research that escape extinction (EE) is not always necessary to treat feeding problems. The current study also supports the hypothesis that individual components can be effective in isolation, if not just as effective, as the treatment package. For this study, all three conditions were effective in increasing acceptance of carrots, and differential reinforcement was equally as effective as the treatment package for acceptance of yogurt. In addition, once a food is accepted, there is the possibility that the child may develop a preference for the food, which could have been a potential factor for the increased acceptance of carrots.

It is not clear what factors resulted in 70% acceptance of bites of bananas for the maintenance check, but it is an interesting data point. The participant may have
had additional positive exposure to bananas in the 3 months following the intervention.

**Limitations**

Considering these results, it is important to note limitations to the current study. First, to participate in the current study, children needed to meet the criteria set for food selectivity of having between 2-7 foods present in their diets, not including snacks or sweets. This definition was selected because it was one of the most objective definitions found in previous research. However, this made it difficult to recruit multiple participants and ultimately led to having only one participant. The results varied across the three foods for the one participant, and additional participants would have added to the research findings relevant to the most effective treatments to increase acceptance of foods in order to better represent the populations of children with feeding issues. In addition, for children that eat more than seven foods, but are still considered very “picky eaters,” and are rigid with texture, brands, and presentation, continuing to seek a better understanding of what criteria defines food selectivity and other feeding issues remains an important area for research.

Second, although the study took place a minimum of 2 hours following a meal (breakfast or lunch), other snacks were not limited prior to the treatment sessions. This may have altered the motivating operations (MOs) for accepting food. If he had access to other snacks, eating behaviors might be less likely because they would be in competition with other behaviors with momentarily stronger MOs. Also, the items selected as potential reinforcers might have lost some of their reinforcing
effectiveness because they were available outside of the experimental conditions (i.e., during his ABA therapy sessions, and/or his non-therapy settings).

Third, multiple formal generalization probes were not conducted. Therefore, objective information about generalization patterns with his guardians in the home and community are not available.

**Future Research**

It may be beneficial to increase saliency of the items and potentially increase motivation to earn the items as reinforcement by reserving them solely for acceptance of the targeted foods. Snacks could also be limited prior to the presentation of the target foods to ensure satiation is not a limiting factor. In addition, future research may look to select foods that are consistent in texture and other critical characteristics to control potential confounds related to these variables.

The present study was conducted only at the Kendall Center, and not attempted across settings, such as the home and community. In addition, family members were not involved in the conducted research and generalization data across settings, forms of food (e.g., carrot sticks versus cut up carrots, whole banana versus cut up banana) were not collected, which should be included in future research. In addition to the generalization of the targeted foods, generalization of the food acceptance methods would be helpful. Family members (if trained in the experimental procedures) would know how to use the components and/or treatment package in the home and community to potentially increase acceptance of novel foods not targeted in the study.
Conclusion

Continuing to work towards effective treatments for feeding problems remains an important area for future research, as well as the important role of defining food selectivity. Past research shows the extensive variety of effective treatments, as well as complexities of feeding problems among typically developing and developmentally delayed populations alike. The current study investigated mechanisms that may be responsible for behavior change by analyzing individual components within the treatment package itself. These results provide evidence that individual components of a treatment package, that may be easy for caregivers to administer, can be effective on their own. Recognition must be given to the fact that what works for one child may not work for another, and what works for one food may not work for another. Effective reinforcement, tolerating textures of foods, awareness of others, and considering shifting motivating operations are all important considerations. With the number of families affected by children with feeding problems, both typically developing and those with developmental disabilities, it is a critical area that future research should continue to explore. Therefore, research should continue to seek out the simplest and most effective ways to increase acceptance of foods, not discounting the potential resources of peers, siblings, and salient reinforcement nor the complexity of this severe problem.
REFERENCES


family food choices in children with and without autism spectrum disorder. 

*Journal of Autism and Developmental Disorders, 45*(10), 3308-3315.


APPENDIX A

RECRUITMENT FLYER

Dear Clinical staff,

I will be conducting a study on increasing acceptance of foods not presently in the child’s repertoire. The purpose of the study is to compare the components of a treatment package (composed of differential reinforcement and peer modeling) independently, with the treatment package as a whole. If you know of any clients that meet the following criteria, please refer them for this study.

Inclusion criteria:
- Age: 3-6
- Currently receiving services at the Kendall Center
- Possesses language comprehension for basic instructions
- Generalized imitation of object-mediated actions
- Diet consisting of eight or less foods (not including sweets or snacks)
- Refusing foods from at least one of the food groups of fruit, starch, protein, and vegetable,
- Minimal exposure to food programs in which increasing food repertoire was not successful OR no prior exposure to food programs

If you have any questions please contact me:

Jennifer Black
Jennblack912@gmail.com
(209) 277-2850
CSU Stanislaus, graduate student

Or you may contact my thesis chair:

Dr. Bruce Hesse
bhesse@csustan.edu
CSU Stanislaus, Professor

For more information about the proposed study see:

APPENDIX B

PARENTAL INFORMED CONSENT

Dear Parent(s) of _____________________________,

My name is Jennifer Black and I am a graduate student at CSU Stanislaus pursuing a Masters degree in Psychology with a concentration in Behavior Analysis. As part of the degree requirements I will be conducting a study supervised by Dr. Bruce Hesse of CSU Stanislaus, to understand what may help children accept more foods into their current eating habits. I am particularly interested in how peer modeling and rewards may increase acceptance.

My intervention involves three conditions including rewards where they child will earn a selected item for acceptance of food, peer modeling, and a treatment package involving both of these conditions.

Your son or daughter has been identified as a potential participant for this study. With your permission, your son or daughter will participate for up to 10 minutes at a time, 1-2 times per day, up to 5 times per week, for up to 30 days. The only known risks for your son or daughter’s participation is discomfort with being presented by non-preferred foods, which may result in a response of crying, possible choking from foods presented, and an allergic reaction to foods not previously consumed. However, if any beneficial effects are observed as a result of the study, your clinical staff will be informed, and the information may be utilized to improve your child’s intervention. Sessions will take place at the Kendall Center during normal Center hours and we do not anticipate that it will interfere with their ongoing behavioral programming. If at any point the study interferes with their treatment, they will be excused from the study. You will also be able to withdraw consent at any time without any penalty. All study materials will be stored in a locked box, and only the researchers involved with this study will have access to them. If interested, I will discuss the general results with you following the completion of this study.

Upon providing consent, your son or daughter will be assigned an alias. His or her real name will not be used on any materials pertaining to the study with the exception of this consent form.

If your son or daughter is selected to participate, the lead researcher requests access to their treatment records, as the information pertains to inclusion criteria such as: diagnoses and history in early intensive behavioral therapy (EIBT) program. Your child’s file, and the information contained therein, will not be distributed to any other party outside of this study.

Your signature below indicates that (a) you have read and understand the purpose and procedure of the study; (b) have indicated permission regarding record considerations.

Parent signature ___________________________ Date ________________

If you are interested in learning more about increasing acceptance of food not presently in children’s eating habits, the current study is based upon the following:

37

If you have any further questions, please feel free to contact me at the email address below. I am also available to explain in more detail the purpose and procedures of the study by request.

Jennifer Black  
Jennblack912@gmail.com  
CSU Stanislaus, graduate student

Or you may contact my thesis chair:

Dr. Bruce Hesse  
bhesse@csustan.edu  
CSU Stanislaus, Professor
Dear Parent(s) of _____________________________,

My name is Jennifer Black and I am a graduate student at CSU Stanislaus pursuing a Masters degree in Psychology with a concentration in Behavior Analysis. As part of the degree requirements I will be conducting a study supervised by Dr. Bruce Hesse of CSU Stanislaus, to understand what may help children accept more foods into their current eating habits. I am particularly interested in how peer modeling and rewards may increase acceptance.

My intervention involves three conditions including rewards where they child will earn a selected item for acceptance of food, peer modeling, and a treatment package involving both of these conditions.

Your son or daughter has been identified as a potential peer helper for this study. With your permission, your son or daughter will participate for up to 30 minutes at a time, 1-2 times per day, up to 5 times per week, for up to 30 days. The only known risks for your son or daughter’s participation is discomfort with being presented by non-preferred foods, possible choking from foods presented, and an allergic reaction to foods not previously consumed. No identifying information or data regarding your child will be utilized during this study. If your son or daughter is selected to be a peer helper, the lead researcher will only report on general information, such as gender and age. You will also be able to withdraw consent at any time without any penalty. General results following the conclusion of the study will be available upon request.

Your signature below indicates that (a) you have read and understand the purpose and procedure of the study; (b) have indicated permission to use your son or daughter as a peer helper in the study.

Parent signature ___________________________________ Date _______________

If you are interested in learning more about increasing acceptance of food not presently in children’s eating habits, the current study is based upon the following:


If you have any further questions, please feel free to contact me at the email address below. I am also available to explain in more detail the purpose and procedures of the study by request.

Jennifer Black
Jennblack912@gmail.com
CSU Stanislaus, graduate student
Or you may contact my thesis chair:

Dr. Bruce Hesse  
bhesse@csustan.edu 
CSU Stanislaus, Professor
APPENDIX D

DATA COLLECTION – ALL CONDITIONS

Date: _____ Observer: ________ Participant: _____ IOA Collected (Circle): Yes   No

Record the food presented and circle the appropriate letter(s) of child’s response to bite for acceptance and inappropriate mealtime behavior (IMB) presented using key listed below. If IMB occurs, record the duration in seconds, using a stop watch.

<table>
<thead>
<tr>
<th>IMB</th>
<th>A</th>
<th>Acceptance</th>
<th>PA</th>
<th>Partial acceptance</th>
<th>NA</th>
<th>No acceptance</th>
<th>NC</th>
<th>Negative comments</th>
<th>C</th>
<th>Crying</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accept</strong></td>
<td></td>
<td>Independently picking up the food with fingers or using utensil, placing the food into his or her mouth, opening mouth and chewing the bite, and swallowing the entire bite presented with the absence of expulsion or regurgitation</td>
<td></td>
<td>Same as acceptance, but swallowing less than the entire bite</td>
<td></td>
<td>Not accepting any of the bite presented</td>
<td></td>
<td>Saying something negative about the food</td>
<td></td>
<td>Crying with tears present</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>IMB</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pushing/throwing food or utensils</td>
<td></td>
<td>Pushing/throwing food or utensils more than 3 inches away from child</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Expulsion</td>
<td></td>
<td>After putting food past lips, expels food out of mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gagging</td>
<td></td>
<td>Retching or choking sounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vomiting</td>
<td></td>
<td>Regurgitation of previously swallowed food</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Food:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Accept</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>IMB if applicable</td>
</tr>
</tbody>
</table>
APPENDIX E

PARENT SURVEY

On average, how many meals does your family eat together in a week? ______

How many children do you have? ______

Please list all allergies: ___________________________________________________
______________________________________
_________________________________

List out 10 foods your family eats that your child does not consume.

1. ________________________________
2. ________________________________
3. ________________________________
4. ________________________________
5. ________________________________
6. ________________________________
7. ________________________________
8. ________________________________
9. ________________________________
10. ________________________________
APPENDIX F

PROCEDURAL INTEGRITY - BASELINE

Check off each box as completed or implemented during the session for all sessions utilizing peer modeling in isolation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Data collector</th>
<th>IOA?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
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<td></td>
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</table>

States prior to every trial conducted with participant “Take a bite.”

Recorded data after food was removed or accepted

Removed food out of view after 10 seconds if food was not accepted (+/-/NA)

Recorded inappropriate mealtime behavior data or absence of inappropriate mealtime behavior on ABC chart
APPENDIX G

PROCEDURAL INTEGRITY – CONDITION A: DIFFERENTIAL REINFORCEMENT

Check off each box as completed or implemented during the session for all sessions utilizing differential reinforcement in isolation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Data collector</th>
<th>IOA?</th>
<th>Yes</th>
<th>No</th>
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</table>

- Conducted MSWOR preference assessment to identify three main reinforcers to be offered
- Offered choice between three reinforcers prior to every trial
- Stated prior to every trial “Take a bite, get (selected reinforcer).”
- Recorded data after food was removed or accepted
- Presented tangible reinforcer for 15 seconds or correct size of edible reinforcer following consumption (+/-/NA)
- Removed food out of view after 10 seconds if food was not accepted (+/-/NA)
- Recorded inappropriate mealtime behavior data or absence of inappropriate mealtime behavior on ABC chart
APPENDIX H
PROCEDURAL INTEGRITY – CONDITION B: PEER MODELING

Check off each box as completed or implemented during the session for all sessions utilizing peer modeling in isolation.

<table>
<thead>
<tr>
<th>Date</th>
<th>Data collector</th>
<th>IOA?</th>
<th>Yes</th>
<th>No</th>
</tr>
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</table>

Conducted rehearsal with peer prior to beginning session with participant

Rehearsal consisted of reviewing with peer to eat the bite in a timely manner and make a positive comment in order to earn peer’s selected reinforcer

States prior to every trial conducted with peer “Take a bite.”

Does not give peer praise for acceptance of food

States prior to every trial conducted with participant “Take a bite.”

Recorded data after food was removed or accepted

Removed food out of view after 10 seconds if food was not accepted (+/-/NA)

Recorded inappropriate mealtime behavior data or absence of inappropriate mealtime behavior on ABC chart

Provided peer with reinforcement after participant leaves eating area
APPENDIX I

PROCEDURAL INTEGRITY – CONDITION C: PEER MODELING + DIFFERENTIAL REINFORCEMENT

Check off each box as completed or implemented during the session for all sessions utilizing peer modeling and differential reinforcement.

<table>
<thead>
<tr>
<th>Date</th>
<th>Data collector</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>IOA?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</table>

Conducted rehearsal with peer prior to beginning session with participant

Rehearsal consisted of reviewing with peer to eat the bite in a timely manner, make a positive comment, and play with participant’s selected tangible or consume participant’s selected edible in order to earn peer’s selected reinforcer

States prior to every trial conducted with peer “Take a bite, get (participant selected reinforcer).”

Provides peer with verbal praise and participant selected reinforcer for accepting bite.

States prior to every trial conducted with participant “Take a bite, get (participant selected reinforcer).”

Recorded data after food was removed or accepted

Removed food out of view after 10 seconds if food was not accepted

Provides participant with verbal praise and participant-selected reinforcer for accepting bite

Recorded inappropriate mealtime behavior data or absence of inappropriate mealtime behavior on ABC chart

Provided peer with reinforcement after participant leaves eating area