An Evaluation of Sequential Meal Presentation with Picky Eaters

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Abstract

Results of previous research evaluating sequential presentation of nonpreferred (NP) and high-preferred (HP) foods have been mixed, and little is known about how preferences for foods and the manner in which they are presented impact consumption. In many households, NP and HP foods are presented together on the same plate (total meal presentation). This was true for the participants included in this study; thus, total meal presentation served as a baseline against which to compare the effects of an appetizer presentation method and subsequently sequential presentation (differential reinforcement). Results demonstrated that presenting NP foods as an appetizer was not successful in increasing consumption. Consumption only increased after HP foods were made contingent on consumption of the NP food.

Keywords Sequential presentation · Food selectivity · Differential reinforcement

Picky eating is a common childhood difficulty reported by parents each year (Carruth & Skinner, 2000). In fact, the percentage of children identified as picky eaters has been reported to be as high as 50% by 24 months of age (Carruth, Ziegler, Gordon, & Barr, 2004). It is estimated that *at any point in time* between 13% and 35% of parents report that at least one of their children is a picky eater (Mascola, Bryson, & Agras, 2010; Rogers, Magill-Evans, & Rempel, 2012). Although definitions of picky eating vary widely and there is no single definition that has been extensively adopted, it is commonly characterized by strong food preferences and limited intake of both familiar and unfamiliar foods (Taylor, Wernimont, Northstone, & Emmett, 2015).

Picky eaters often engage in some form of disordered feeding behavior (Carruth et al., 2004). Namely, it is commonly reported that picky eaters refuse to try new foods when

presented with the opportunity (Cathey & Gaylord, 2004), as in the case of *food selectivity*, which has been formally defined as the consumption of a limited variety of foods, as well as the rejection of most novel foods when presented (Levin & Carr, 2001). This definition closely resembles descriptions of picky eating; however, picky eating can be distinguished from food selectivity in that picky eaters generally eat at least one food from each food group whereas children with food selectivity may avoid entire food groups altogether (Food selectivity, 2017).

Almost all children go through a period of picky eating, which frequently coincides with normal developmental growth patterns (Carruth et al., 2004). Children often resume healthy eating behaviors; however, for some children, picky eating can evolve into more serious feeding difficulties, such as food selectivity (Carruth et al., 2004; Cathey & Gaylord, 2004). The effects of such feeding problems on the growth and development of a child can be severe. A multitude of health problems can result, such as the insufficient intake of nutrients leading to malnutrition, inadequate weight gain, retardation in growth, fecal impaction, and severe weight loss resulting in a diagnosis of failure to thrive (Kerwin, 1999). Thus, it is important to address picky eating in an effort to prevent the development of a more severe feeding disorder, as it may be difficult to predict whether or not picky eating will resolve on its own (Carruth et al., 2004). In a study conducted by Ekstein, Laniado, and Glick (2010), it was concluded that picky eating patterns place children at greater risk of being

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underweight. Further, picky eating may be accompanied by inappropriate mealtime behaviors that could negatively impact the child's relationship with other members of the family and impede family functioning, as well as opportunities for socialization.

Picky eating may be addressed by simple consequence manipulations that can easily be implemented by parents in the natural environment. One such intervention was the focus of this study: sequential food presentation. Sequential presentation is a consequence manipulation (differential reinforcement procedure) that involves the contingent presentation of a high-preferred (HP) food following acceptance or consumption of a nonpreferred (NP) food (e.g., Najdowski, Wallace, Doney, & Ghezzi, 2003). Numerous studies have demonstrated that sequential presentation is effective when implemented in conjunction with other treatment components, such as escape extinction and demand fading (e.g., Najdowski et al., 2003; Najdowski et al., 2010; Seiverling, Kokitus, & Williams, 2012); however, when sequential food presentation has been examined in the absence of other treatment components, namely escape extinction, results have been mixed. For example, Penrod, Wallace, Reagon, Betz, and Higbee (2010) conducted a component analysis and found that bite fading and sequential presentation were effective in increasing consumption for one of three participants in the absence of escape extinction in the form of a nonremoval-of-the-spoon procedure (NRS), whereas consumption for the other two participants did not increase until after NRS was introduced. In a later study, Pizzo, Coyle, Seiverling, and Williams (2012) found that sequential presentation *was* effective in the absence of escape extinction; however, the study was limited to a single participant.

The independent effects of sequential food presentation have also been evaluated in comparison to simultaneous presentation in which an HP food and an NP food are presented together on the same spoon or fork (Piazza et al., 2002). For example, Penrod and VanDalen (2010) compared the emerging preference for NP foods when presented simultaneously versus sequentially. According to the authors, no differential results were found between the two conditions; that is, neither simultaneous presentation nor sequential presentation was effective as a single treatment component. Consumption did not occur until NRS was introduced. However, the authors anecdotally noted that in the simultaneous condition, participants elected to separate the NP and HP foods and eat them in a sequential fashion, suggesting that some children may prefer to consume the NP food separate from their HP food. It is also possible that motivation to consume NP foods is increased when there is a reinforcement contingency in place for consumption.

In summary, results of previous research evaluating sequential presentation have been mixed. Moreover, little is known about how preferences for food and the method in

which they are presented may impact the maintenance of food consumption. Although most caregivers do not present NP food together with an HP food on the same spoon or fork (simultaneous presentation), in many households, HP and NP foods are presented together on the same plate, a presentation method hereafter referred to as *total meal presentation*. Another presentation method commonplace in some households is a form of sequential presentation in which parents initially present NP foods, and after some period of time with little or no consumption, they present the child's HP foods. Whereas sequential presentation, as described in the literature, generally refers to the *contingent* presentation of an HP food, we refer to this variation as an *appetizer presentation*, similar to how different foods are often served in a restaurant, with one food presented as a starter followed by another food that is presented regardless of whether the diner has finished his or her starter.

There may be benefits and drawbacks to each of the aforementioned presentation methods. For example, the appetizer presentation method may be advantageous in that there is likely a stronger establishing operation in effect at the beginning of the meal, presuming the child is hungry. On the other hand, a potential benefit of the total meal presentation method is that the presence of the HP food on the same plate as the child's NP food may serve as an abolishing operation for inappropriate mealtime behavior. However, one pitfall of this presentation method is that the child could consume all of the HP food without consuming the NP food. This was true for the participants included in this study; thus, total meal presentation served as a baseline against which to compare the effects of sequential presentation. Given that the appetizer presentation may capitalize on a naturally occurring establishing operation (i.e., hunger), we also wanted to evaluate whether this presentation method offered any benefit over the total meal presentation method. Thus, prior to the introduction of sequential presentation, we evaluated an appetizer presentation method in which a portion of the NP food was initially presented by itself for a period of time and then the HP food was presented regardless of whether the child consumed the NP food or not. When consumption did not increase, a subsequent treatment phase was introduced in which the HP food was only provided contingent on consumption of the NP food (i.e., sequential presentation).

As previously mentioned, little is known about how preferences may impact the maintenance of food consumption given that escape prevention procedures are often included as a component of treatment, making it difficult to rule out the possibility that consumption maintains through the process of negative reinforcement. Thus, another aim of this study was to compare emerging preferences for target NP foods with children who were considered picky eaters and who had no prior history of exposure to escape prevention procedures. For the purpose of this study, we defined *picky eating* as

consumption of a restricted number of foods (i.e., less than three) in at least one food group and resistance to trying new foods when presented.

Method

Participants

Two typically developing brothers participated in this study. Lars (age 6) and Marshall (age 3) were both reported by their parents to be picky eaters. The siblings were referred to the Pediatric Behavior Research Laboratory at California State University, Sacramento, to address their picky eating behavior. Both Lars and Marshall could self-feed, and they ate a variety of foods, including many processed starches (e.g., Cheerios, crackers, Cheetos, etc.), some fruits, and a limited number of proteins (i.e., hot dogs, sausage, and ham), while refusing most other foods within the category. Both children used to consume additional foods including hummus, avocado, carrots, ground beef, and bananas. According to parent report, neither Lars nor Marshall would eat vegetables, following a self-generated rule that they would not eat anything green. There was no oral motor or underlying medical factors indicated by the parents, and neither child had been treated previously for picky eating or food-related difficulties. Both children were considered to be at risk for developing more severe feeding problems if left untreated, especially given the number of previously eaten foods that had been dropped from their diet.

Both children were reported to engage in mealtime problem behaviors. Lars engaged in refusal behaviors, including making negative statements about the food (e.g., “I don’t like cucumbers,” or “Cucumbers are yucky.”); saying, “I don’t want to eat that today,” when presented with an NP food; and pushing the plate away. Marshall engaged in food-refusal behaviors, including crying, vocal protesting (negative statements in an escalated/raised tone of voice), attempting to leave the table, attempting to throw food, and falling to the floor. However, most of these behaviors were short in duration and could often be redirected after several minutes of casual mealtime conversation.

Setting and Materials

All sessions took place within the family home, at the dinner table where meals normally occurred, with the parent as the primary implementer. This was done in order to increase generalization to the natural environment where the children most often consumed their meals. In addition, the brothers received their meals at the same time, and the parents dined with them. This arrangement most closely represented the regular mealtime routine of the family. Sessions occurred during dinner,

two to three times per week, and all meals were terminated after 20 min had elapsed. Also present in the room was the primary researcher, who participated in casual mealtime conversation while at the table, and an additional research assistant attended some sessions in order to collect treatment integrity data on the implementation of the procedure.

Measurement of the Dependent Variable

All sessions were video recorded. During preference assessments, data were collected on the number of trials that each food was consumed. Consumption was scored any time the participant picked up a bite of food and placed the food past the plane of his lips in the absence of expulsion (i.e., no food larger than the size of a pea was observed outside of the participant’s mouth following acceptance of the bite). The number of bites consumed was then divided by the total number of trials each food was presented and converted to a percentage. During experimental conditions, the total weight of NP food consumed was measured in grams. This was done by weighing the plate with the NP food prior to presentation of the meal (and before the HP food was placed on the plate during total meal presentation) and weighing the plate again at the end of the meal. Any remaining HP food was removed from the plate and any remaining NP food not on the plate (e.g., food that fell to the floor) was retrieved and placed back on the plate before weight was recorded; the difference in weight was recorded as the grams consumed. Total grams consumed was divided by total grams presented and converted to a portion of the serving consumed. Data were also collected on the total meal duration (data available upon request), with meal onset defined as the moment the plate was placed in front of the participant and offset defined as a clean mouth (no food larger than the size of a pea remaining in the participant’s mouth), which was determined by a single mouth-clean check following acceptance of the final bite on the plate, or the termination of the meal at the 20-min cutoff time.

Interobserver Agreement and Treatment Integrity

Interobserver agreement (IOA) was collected on the number of grams consumed of the target (NP) food and total meal duration. IOA was calculated for 100% of sessions using the total agreement method. This was done by dividing the smaller number by the larger number and then multiplying by 100 for a percentage of agreement. Mean IOA for the number of grams consumed was 100% and for the meal duration was 96% (range 92%–100%).

Treatment integrity was collected on the parent’s delivery of instructions, meal presentation, and meal termination during 100% of sessions. Two observers collected IOA for treatment integrity for 56% of randomly selected sessions using the point-by-point agreement method, by dividing the number

of agreements by the number of agreements plus disagreements, and then multiplying by 100 for a percentage of agreement. Agreements were defined as both observers scoring the same response on the same item (e.g., both observers checking “yes” or both observers checking “no”). Disagreements were defined as the two observers scoring different responses on the same item (e.g., one observer checking “yes” and the second observer checking “no”). The parent’s overall treatment integrity across procedures was 93% (range 85%–100%), and IOA on treatment integrity was 98% (range 96%–100%) across the sampled sessions.

Experimental Design

A concurrent multiple-probe design was used to replicate the effects of contingent presentation (i.e., differential reinforcement) and volume fading (for Marshall only) across two different NP foods. Each session (meal) was composed of a pair of foods, one HP food and one NP food (e.g., corn [NP food] and macaroni and cheese [HP food]). Initially, both target NP foods were presented under baseline conditions—that is, both foods were presented together on the same plate as the child’s HP food (total meal presentation). Prior to introducing the contingent presentation condition, an appetizer presentation condition was introduced with one of the two target foods; however, because the appetizer presentation did not result in increased consumption, it was not applied to the second food.

Preference Assessments

Paired-choice preference assessments were conducted prior to beginning data collection, following the procedures described by Fisher et al. (1992). The HP and NP foods that were used in the experimental conditions were determined based on the results of these initial preference assessments. One 12-item assessment including 4 HP foods and 8 NP foods was conducted. All food items in the assessment were determined based on child and caregiver report. The items selected for treatment were foods typically served in the participants’ home. One food that was selected the highest number of opportunities (suggesting higher preference) was selected as the HP food (defined as a food chosen between 70% and 100% of opportunities) and was paired with two NP foods (i.e., selected on less than 20% of opportunities during the assessment) to make up the two meal dyads of one HP food + one NP food. The same HP food was paired with both NP foods to control for slightly higher preferences for one food over another being a possible controlling variable that could increase the likelihood of consumption.

Total Meal Presentation (Baseline)

During all baseline sessions, the parent presented the meal in a manner typical of how the family normally presented meals at home (i.e., both foods on the same plate). A beginning statement was provided as the plate was presented in front of the child: “Here is your dinner.” The plate had one age-appropriate portion of both the NP and HP foods. For the HP food, parents were asked to show the primary researcher the portion they would normally serve. This portion was then weighed, which equated to 82 g for Lars (approximately 1 cup) and 58 g for Marshall (approximately $\frac{3}{4}$ cup). The portion of NP food presented to Lars and Marshall equated to 38 g (approximately $\frac{1}{2}$ cup) and 26 g (approximately $\frac{1}{3}$ cup), respectively. If the child consumed the entire meal within 20 min, praise was briefly provided in a natural manner for finishing his meal (e.g., “Great, you ate everything.”). After 20 min had elapsed, if the child did not finish his food, the plate was removed. A neutral statement, such as “OK, dinner-time is over now,” was made and the child was allowed to leave the table. Each session was terminated after 20 min had elapsed. If the child finished his meal before 20 min had elapsed, casual dinner conversation would continue, and the child was permitted to leave the table when the 20-min timer went off. Parents were instructed to interact with their children as they typically would but refrain from attending to any inappropriate mealtime behavior (e.g., negative statements about the food).

Treatment 1: Appetizer Presentation

During the appetizer condition, the NP food was presented before the HP food and the child was told, “Here is your appetizer. The main dish will be served soon.” After 10 min had elapsed, or after the child had consumed all of the NP food (whichever came first), the HP food was presented and the child was told, “Here is your main dish.” If the child had not finished his appetizer (NP food) after 10 min had elapsed, the main dish was still presented, and the appetizer plate remained on the table next to his main dish so the child would have the same amount of time to consume the NP food as in the total meal presentation condition described previously. If the child consumed the entire meal (both the HP and NP foods) within 20 min, brief praise was provided as noted previously, and natural dinnertime conversation would continue until 20 min had elapsed, at which point the child could be excused from the table. After 20 min had elapsed, if the child did not finish his food, both the appetizer plate and the dinner plate were removed. A neutral statement, such as, “OK, dinnertime is over now,” was made and the child was allowed to leave the table. If the child did not consume all of his NP food, the parents were then asked to avoid providing any food to the child for at least 1 h following the termination of the meal.

This request was made in an attempt to increase the child's motivation to eat during the session because food was not readily available after the session had ended. It should be noted that consumption of the entire portion of HP food was not required, as it was not the target of treatment.

Treatment 2: Contingent Presentation

This condition was the same as the previous appetizer presentation condition with one exception. Instead of presenting the HP food after 10 min had elapsed regardless of whether the child consumed the NP food, the HP food was only presented contingent on the consumption of the NP food. When the NP food was presented, the following statement was made: "Here is your appetizer; the main dish will be served after you've eaten all of your [name of food]." This is a differential reinforcement procedure wherein the HP food is provided as reinforcement for consumption of the NP food. If the NP food was not consumed within 20 min, then the HP food was not presented and the meal was terminated. The experimenter removed the plate with the NP food, and stated, "OK, dinner-time is over now." In the event that the child did not finish the NP food, as with the previous conditions, the parents were asked to avoid providing any food to the child for at least 1 h following termination of the meal.

Volume fading was added for Marshall only. Within this condition, presentation of the meal and vocal statements of the contingency remained the same as in the contingent presentation. The volume-fading procedure involved presenting a reduced volume of food. This was done to increase the likelihood of Marshall contacting the contingency of gaining access to the rest of his dinner following consumption of the NP food. Initially, only one bite of the treatment food (2 g) was presented. The criterion for increasing volume was one session with 100% consumption. During the following two sessions, Marshall was presented with two bites (6 g) and four bites (12 g), respectively, after which the full portion size was reintroduced.

Results

During total meal presentation for Lars, the mean portion of NP foods consumed was 9.25% (range 0%–19%) for cucumber and 14.43% (range 0%–38%) for corn. When appetizer presentation was applied to cucumber, an increase in consumption was not observed (mean portion of serving consumed was 1.67%; range 0%–5%). Following the introduction of the contingent presentation during Session 15, Lars contacted the contingency of not receiving the rest of his dinner because he did not consume the NP food (cucumber) when it was presented as an appetizer. Lars did not consume an entire portion of the NP food until Session 16 of the contingent

presentation. The entire portion of the cucumber was consumed in all subsequent sessions. Beginning with Session 23, the contingent presentation was applied to corn, and Lars consumed 100% in all subsequent sessions (see Fig. 1).

During total meal presentation for Marshall, the mean portion of NP foods consumed was 0% for cucumber and 1.71% for corn (range 0%–4%). When appetizer presentation was applied to cucumber, an increase in consumption was not observed (mean portion of serving consumed was 0%). Following the introduction of the contingent presentation during Session 15, Marshall contacted the contingency of not receiving his HP food, after which he consumed several small bites of cucumber in Sessions 16 and 17. Although consumption was increasing for Marshall, the volume of NP food that was consumed was only one to two bites, which was not a clinically significant portion. Therefore, volume fading was added during Sessions 18, 19, and 20. During these sessions, Marshall contacted the reinforcement contingency of receiving the rest of his dinner after finishing the NP food. During Session 21, Marshall was again presented with an entire portion of cucumber and he consumed the entire portion in all subsequent sessions. Beginning with Session 23, the procedure was then applied to corn, after which he also consumed 100% of opportunities (see Fig. 2).

Both Lars and Marshall demonstrated an increase in preference for the NP foods targeted (see Figs. 3 and 4). For Lars, cucumber was selected and consumed 67% of opportunities during the posttreatment preference assessment compared to 0% of opportunities during the pretreatment preference assessment and corn was selected and consumed 42% of opportunities during the posttreatment preference assessment compared to 14% of opportunities during the pretreatment preference assessment. For Marshall, cucumber was selected and consumed 72% of opportunities during the posttreatment preference assessment compared to 0% of opportunities during the pretreatment preference assessment and corn was selected and consumed 54% of opportunities during the posttreatment preference assessment compared to 0% of opportunities during the pretreatment preference assessment.

Discussion

Results demonstrated that presenting NP foods as an appetizer was not successful in increasing consumption. Consumption only increased after the HP food was made contingent on consumption of the NP foods. After contacting the contingency in the contingent presentation (and three sessions of volume fading for Marshall), consumption of NP food increased to 100% for both participants. It is possible that the appetizer presentation was not effective in part due to the participants' history of reinforcement during family mealtimes. Based on conversations with the participants' parents, we suspect that in

Fig. 1 Graph depicting the portion of servings Lars consumed during total meal presentation, appetizer presentation, and contingent presentation across two different foods: cucumber depicted in the top panel, and corn depicted in the bottom panel

the past, when participants engaged in mealtime refusal behaviors for an extended period of time, the parents may have then provided an alternative meal. For parents, this choice is often motivated by the fear that their child has not consumed an adequate number of calories. Consequently, parents may inadvertently teach their child that food-refusal behaviors may result in a more preferred dinner option presented at a later time if the child waits long enough. Contingent presentation changes this reinforcement contingency, in that the preferred dinner options were only available following the consumption

of the NP food, and those preferred foods were not available later if the NP food was not consumed.

Although the effects of contingent presentation (and volume fading for Marshall) were replicated across foods, it should be noted that the sequence in which treatment conditions were introduced limits the conclusions that can be drawn from the current study. More specifically, contingent presentation and volume fading may have been just as effective with both the HP and NP foods presented together on the same plate. Rather than making the HP food contingent on

Fig. 2 Graph depicting the portion of servings Marshall consumed during total meal presentation, appetizer presentation, and contingent presentation plus volume fading (VF) across two different foods: cucumber depicted in the top panel, and corn depicted in the bottom panel

Fig. 3 Percentage of trials with consumption for Lars during the pre- and posttreatment preference assessments, depicted by the black and gray bars, respectively

consumption of the entire portion of NP food, parents could require their child to alternate bites of his or her HP food with bites of the NP food or could reinforce consumption of the entire meal by offering a highly preferred dessert or access to a highly preferred activity at the end of the meal. In some respects, presenting the HP and NP foods together on the same plate may be easier for parents to manage; thus, future research should evaluate the effects of differential reinforcement and volume fading when NP and HP foods are presented sequentially versus simultaneously. Future research should also assess reinforcement effects of stimuli included in evaluations of differential reinforcement. It is noteworthy that during baseline, Lars occasionally consumed a small amount of both NP foods (this percentage usually equated to one to three bites; see Fig. 1) and he often made statements like, “I think I’ll try corn today”; however, when those bites were not followed by any additional praise or reinforcement, he did not continue to consume the NP food and finished consuming the HP food on his plate. Given this observation, it is possible that praise alone or other stimuli may have functioned as a reinforcer for consumption.

Additionally, future research should evaluate the independent effects of differential reinforcement procedures. In the current study, the possibility that other variables influenced consumption cannot be ruled out entirely. Given that the two participants included in the study are brothers, they were treated simultaneously, and the same treatment foods were selected for both. The reason this was done was to better mimic a natural mealtime at home. However, mimicking a natural mealtime means it is harder to experimentally control for other influences on consumption, such as modeling (observational learning). Though it is unlikely that modeling alone would have resulted in increased consumption—supported by the fact that Marshall observed Lars consuming his NP food and receiving his dinner during several sessions, yet consumption for Marshall still did not increase—it is impossible to say if Marshall would have been as motivated to consume in the volume-fading sessions if he had not been watching his brother and family consume dinner without him.

It is important to note that in previous studies evaluating differential reinforcement procedures, results have been mixed. This may be explained by different

Fig. 4 Percentage of trials with consumption for Marshall during the pre- and posttreatment preference assessments, depicted by the black and gray bars, respectively

participant characteristics across studies (e.g., diagnoses, types of feeding problems), thus more research is needed in order to determine the profile of children this treatment is best suited for.

For children considered to be picky eaters, differential reinforcement may be a viable and easy procedure for parents to implement within the natural environment; however, for children with more severe food-refusal behaviors, such as those with food selectivity, differential reinforcement may not be effective as a single treatment component given these children may have a much longer history of refusal behaviors or may engage in more serious mealtime problem behaviors in which they continue to refuse food even when hungry.

Particularly noteworthy is the fact that preferences for the target NP foods included in the study increased for both participants posttreatment. The differential reinforcement contingency (plus volume fading for Marshall) effectively increased consumption of NP foods, and once participants were consuming these foods, their preference shifted. In addition to the posttreatment preference assessment data, anecdotal observations provide further support that preferences for the NP foods did in fact increase. For example, Lars started eating cucumber during Session 16, and during Session 21, he requested additional cucumber and made some positive statements about the NP food (i.e., “I like cucumber now.”). It is possible that contingencies are instrumental in bringing the child into contact with NP foods but that continued consumption of those foods may be attributed to changes in preference. Long-term follow-up sessions may help elucidate the role of preferences in the maintenance of consumption for foods first introduced into a child’s diet through contingency management.

Implications for Practice

- Is an easily generalizable treatment strategies designed to address picky eating;
- Is an unobtrusive consequence-based intervention that can be implemented by caregivers;
- Has implications for prevention of food selectivity;
- Has implications for research evaluating differential reinforcement contingencies.

Compliance with Ethical Standards

Conflict of Interest The first author declares that she has no conflict of interest. The second author declares that she has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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