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Comparing two variations of the high-probability instructional sequence to improve food consumption with a child with autism

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The present study evaluates the effects of two variations of the high-probability (Hi P) instructional sequence with a child with autism spectrum disorder. In one variation, the Hi P task was topographically similar to the low-probability task of food consumption, whereas the second variation involved Hi P tasks that were not topographically similar to the low-probability task. Results show that both variations of the Hi P sequence were effective at improving consumption and reducing inappropriate mealtime behavior. The participant's mother chose a preferred variation of the Hi P intervention to pursue systematic fading with, the topographically similar Hi P sequence. Consumption remained high and inappropriate mealtime behavior remained low throughout the fading process. Implications for continued research and practice in the area of feeding intervention are provided.

KEYWORDS

autism spectrum disorder, dietary variety, feeding problems, food selectivity, high-probability instructional sequence

1 | INTRODUCTION

The high-probability (Hi P) instructional sequence is an antecedent intervention used to improve compliance. The Hi P sequence involves providing a series (e.g., 3–5) of instructions, which an individual has a demonstrated history of complying with prior to providing an instruction with which they have a low probability (Lo P) of complying with.

The Hi P sequence has been evaluated with a range of populations and targeting various classes of behavior (see Lee, 2005; Lipschultz & Wilder, 2017). The Hi P sequence has also been evaluated in the treatment of food selectivity and refusal, which may be conceptualized as a form of noncompliance.

Dawson et al. (2003) evaluated the effects of the Hi P sequence in the treatment of a 3-year-old girl with food refusal in an inpatient feeding disorders unit. Specifically, researchers evaluated the effects of the Hi P sequence alone and in combination with escape extinction (EE) and found that the Hi P sequence did not improve food acceptance or inappropriate mealtime behavior (IMB). Moreover, the Hi P sequence also did not add to the effects of EE. The Hi P sequence used in this study involved tasks which were topographically dissimilar to the Lo P task of food acceptance (e.g., "touch red"). Patel et al. (2006) also examined the effects of the Hi P sequence in the treatment of feeding disorders. Hi P tasks involved taking bites from an empty Nuk® spoon, Carnation Instant Breakfast® on a spoon, and water on a spoon. For two of the three participants in this study the researchers evaluated the effects of adding the Hi P sequence to ongoing intervention with EE. Results showed that the addition of the Hi P sequence improved both acceptance and IMB (IMB was only measured for one of the two participants). For a third participant, the Hi P sequence was first evaluated alone, and then Hi P + EE was compared with EE alone. The Hi P sequence alone did not result in improvements, though when added to EE the Hi P sequence did result in further reductions in IMB relative to EE alone. Thus, Patel et al. (2006) found there to be some benefit to using the Hi P sequence in combination with EE.

Patel et al. (2007) further evaluated the effects of the Hi P sequence with a 4-year old child with food selectivity. The Hi P sequence examined in this study involved a topographically similar Hi P task, presentations of an empty spoon. Results showed that acceptance was low during baseline and immediately improved to 100% acceptance during the Hi P condition. Importantly, Patel et al. (2007) noted that the participant did not engage in IMB during any of the conditions. Meier, Fryling, and Wallace (2012) evaluated a Hi P sequence involving presentations of bites of preferred foods prior to the presentation of Lo P bites with a 3-year old child with autism spectrum disorder (ASD). Results showed that the Hi P sequence improved acceptance across three foods and that acceptance remained high, whereas the Hi P sequence was faded for two of the three foods. Recently, the results of Meier et al. were systematically replicated by Ewry and Fryling (2016) with an adolescent with ASD. Again, a Hi P sequence involving bites of preferred food (i.e., a topographically similar Hi P sequence) was used and found to improve feeding behavior. Moreover, the child's parent successfully implemented the procedure and had similar results. Importantly, however, results only partially maintained at a 7-month follow-up, indicating that systematic fading may be necessary. Similar to Patel et al. (2007), the participants in Meier et al. and Ewry and Fryling did not engage in IMB.

Although many researchers have evaluated the effects of the Hi P sequence alone and in combination with EE, Penrod, Gardella, and Fernand (2012) evaluated the effects of the Hi P sequence in combination with demand fading. Specifically, two children with ASD with a history of food selectivity participated in an intervention, whereby Hi P tasks were related to food consumption and Lo P tasks were one step closer to the terminal goal. Upon demonstrating compliance with one Lo P task that task was used as a Hi P task for the next step in the sequence. Steps included balancing the food on the child's tongue, taking a bite, consuming one bite, chewing, and swallowing. This variation of the Hi P sequence, involving Hi P tasks that may be considered at least partially topographically similar to the Lo P task, was found to be successful with both participants.

As we have noted in our review of studies on the Hi P sequence in the treatment of feeding problems, successful applications of the Hi P sequence have involved Hi P tasks that were topographically similar to the Lo P task of food consumption. Thus, it seems possible that topographically similar Hi P tasks facilitate response persistence in the presence of Lo P tasks (see Patel et al., 2006, pp. 439–440). Understanding this possibility may have implications for the effective use of Hi P sequences in clinical practice. Still, to our knowledge, there have been no comparisons of Hi P sequences which are topographically similar to those which are not. The aim of the present study is to directly compare Hi P sequences that are topographically similar to Hi P sequences that are topographically dissimilar with a selective eater with ASD.

2 | METHOD

2.1 | Participants and setting

John, a 9-year-old child diagnosed with ASD, participated in the study. John's mother reported that he was a picky eater and frequently refused to eat fruits, vegetables, and chicken. Given this, John's mother identified foods in these areas to use during the evaluation (i.e., as Lo P targets). It is unclear exactly what interventions were tried in the past, though John's mother reported that she had tried several things. John's mother also reported that he engages in IMB (e.g., throwing his plate) on occasion. Prior to participation John's mother indicated that an occupational therapist had cleared John for oral feeding (i.e., John had the prerequisite chewing and swallowing skills).

All sessions were conducted at home at the families' dining room table. John did not consume food for at least 30 min prior to each session. Sessions were conducted 1 to 5 times per week, depending on family availability, and two to four blocks of 10 trials were completed per session. A different color placemat was paired with each condition to facilitate discrimination between conditions. Specifically, a blue placemat was used during the topographically dissimilar Hi P intervention and a red placemat was used during the topographically similar Hi P intervention.

2.2 | Data collection

Acceptance of food was defined as the food passing the plane of John's lips within 5 s of the instruction to "have some" without expelling the food from his mouth. *Consumption* was defined as no food remaining in the mouth at the end of the 30-s trial (i.e., the therapist prompted John to "show me" at the end of each 30-s trial). Each bite consisted of a spoonful of (approximately 5 ml) of food or liquid. *Inappropriate mealtime behavior* (IMB) included turning his head away, putting his head down on the table, and hitting the spoon. The researcher collected data on paper recording forms for compliance with Lo P tasks and IMB.

2.3 | Interobserver agreement

Interobserver agreement (IOA) was assessed for 100% of the compliance assessment sessions and was 100%. IOA was also assessed for a total of 59% of all sessions (57% of baseline sessions, 60% of Hi P similar sessions, 60% of Hi P dissimilar sessions, and 59% of all fading sessions). For baseline, mean IOA was 100% for acceptance and consumption and 99% (range, 90% to 100%) for IMB. For all other conditions, IOA was 100%. IOA was calculated by dividing the number of trials with agreement for compliance of Lo P instructions and IMB by the total number of trials and multiplying this number by 100 to obtain a percentage.

2.4 | Treatment integrity

Treatment integrity was calculated using three separate task analyses (baseline, Hi P similar, and Hi P dissimilar). Steps in the task analysis related to the materials being present, the appropriate discriminative stimuli being provided (e.g., the Hi P and Lo P instructions), providing neutral praise, ignoring IMB, and checking for mouth clean at the end of the 30-s interval. Treatment integrity was assessed for 20% of all sessions. The primary researcher video-taped all of the sessions, and treatment integrity was obtained from these videos. During baseline, integrity was at 100%. During the Hi P dissimilar condition, mean integrity was 99% (range, 91% to 100%). Finally, mean integrity for the Hi P similar condition was 97% (range, 83% to 100%).

2.5 | Design and procedure

The effectiveness of the Hi P sequence was evaluated using a nonconcurrent multiple-baseline across food design, and the two variations of the Hi P sequence were compared using an alternating treatments design.

2.6 | Compliance assessment

A compliance assessment was conducted to demonstrate that compliance with the Hi P tasks was at 100%. The compliance assessment consisted of 10-trial sessions for each of the Hi P tasks (i.e., both topographically similar and dissimilar). Trials began with the discriminative stimulus (Sd); "have some" (for topographically similar Hi P tasks) or "Do this" (for topographically dissimilar tasks). A new trial began every 30 s. Neutral verbal praise was provided for mouth clean or compliance with the dissimilar tasks (e.g., imitating a therapist touching their shoulder).

2.7 | Baseline

During baseline, Lo P bites were placed on a spoon on a plate in front of John and the therapist provided the verbal Sd "have some." Lo P foods were presented every 30 s with 10 bites presented every session. If John did not initiate acceptance within 5 s of the Sd, the therapist removed the bite and waited until the end of the 30-s interval to present the next bite. Consumption was followed by neutral praise (e.g., "ok" and "good"), and there were no differential consequences for problem behavior. Two foods were targeted during each session, with each food being presented 5 times during each 10-bite session (no more than 2 bites of the same food were presented in a row).

2.8 | Hi P dissimilar

During Hi P dissimilar conditions, the therapist presented three topographically dissimilar Hi P tasks prior to the presentation of the Lo P bite. The therapist specifically presented three different Hi P instructions: "touch head," "clap hands," and "give me five," prior to asking John to take a bite of a Lo P (one spoonful approximately 5 ml) food. There were approximately 3–5 s between each Hi P task presentation. At the end of the 30-s interval, the therapist checked for mouth clean and a new bite was presented. The therapist ignored all IMB. Similar to baseline, this process continued for 10 trials, with 5 trials of each food.

2.9 | Hi P similar

Hi P similar conditions were the same as Hi P dissimilar conditions with the exception that three topographically similar Hi P tasks were presented prior to the Lo P tasks. Specifically, three spoons with water were presented (approximately 5 ml), with 3–5 s between each presentation, prior to the presentation of Lo P bites.

2.10 | Differential reinforcement

Differential reinforcement of alternative behavior was planned to be implemented if there was no increasing trend after 10 sessions of each Hi P intervention condition. This never occurred for any of the three food groups.

2.11 | Fading

After each of the Hi P sequences had been compared across each of the three groups of food, the researcher asked the parent to select the Hi P condition that she preferred most to be used during a final fading phase. John's mother selected the Hi P similar intervention to use during fading. For each of the three food groups, the first step of the fading procedure involved presenting two Hi P instructions prior to the presentation of the Lo P bite. When John consumed 80% or more of the Lo P bites for three consecutive sessions, the researcher faded further, presenting one Hi P instruction prior to the Lo P bites. Again, when John consumed 80% or more of the Lo P bites for three consecutive sessions, the researcher fully removed the intervention and presented the Lo P foods alone. When John consumed 80% or more of the Lo P bites with no Hi P instructions for three consecutive sessions, fading was considered to be finished.

2.12 | Social validity

Upon completion of the study, the researcher asked John's mother if she liked the intervention, and John's mother reported that she liked the intervention because it has increased the variety of foods he is consuming. John's mother also reported that he now consumes kiwi, cucumbers, pears, carrots, chicken, and tomatoes consistently.

3 | RESULTS

The results of the evaluation are depicted in Figure 1 (note that only consumption is graphed as acceptance never occurred without consumption and IMB rarely occurred). For the first group of foods, kiwi and cucumber, John consumed 0% of the bites during baseline and engaged in IMB for an average of 6% of the trials (range, 0% to
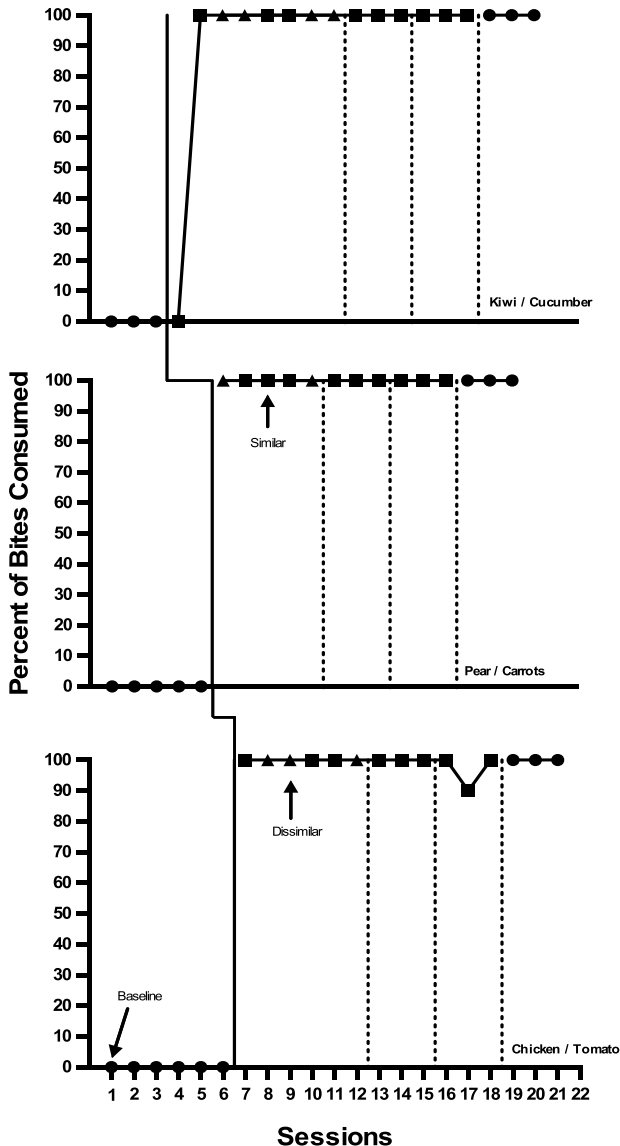

FIGURE 1 Percentage of consumption of Lo P bites

20%). During the Hi P similar condition, John consumed an average of 75% of the bites (range, 0% to 100%) and engaged in IMB 0% of the trials. During the Hi P dissimilar condition, John consumed 100% of bites and engaged in IMB 0% of the trials. During fading, John consumed 100% of bites and did not engage in IMB during any of the phases. For the second group of foods, pear and boiled carrot, John consumed 0% of the bites during baseline and engaged in low rates of IMB (M = .02% of the trials, range, 0% to 10%). During the Hi P similar condition, John consumed 100% of the bites and engaged in 0% of IMB. During the Hi P dissimilar condition, John consumed 100% of bites and engaged in IMB 0% of the trials. During fading, John again consumed 100% of bites and engaged in 0% of IMB across any of the phases. Finally, for the third group of food, tomato and chicken, John consumed 0% of the bites during baseline and engaged in IMB 0% of the trials. During the Hi P similar condition, John consumed 100% of the bites and engaged in no IMB. During the Hi P dissimilar condition, John also consumed 100% bites and engaged in no IMB. John consumed an average of 98% of bites during fading (range, 90% to 100%). John engaged in 0% of IMB during fading.

4 | DISCUSSION

Feeding problems, including restricted diets, are common with individuals with ASD (see Kodak & Piazza, 2008), and it is incumbent upon researchers to identify and evaluate strategies that may be used to improve the variety of foods individuals with ASD consume. The Hi P sequence is one intervention that has been studied in the feeding literature, though with mixed results. Moreover, the mechanisms that are responsible for making the Hi P sequence work, when it does, are unknown. Previous successful applications of the Hi P sequence in the treatment of feeding problems have involved Hi P tasks that were topographically similar to the Lo P task of consuming bites. However, as these studies did not specifically compare topographically similar Hi P tasks to Hi P tasks that were not topographically similar, the extent to which topographical similarity is responsible for these successful applications of the Hi P sequence remains unknown. The present study aimed to specifically assess differences among these two types of the Hi P sequence. There were no differences found in the present evaluation, indicating that the topography of the Hi P task might not be critical. Nevertheless, the Hi P sequence was successful at improving consumption and was successfully faded across three groups of foods.

One important factor to consider when evaluating the effectiveness of an intervention for feeding problems is the presence or absence and severity of IMB. Seubert, Fryling, Wallace, Jimenez, and Meier (2014) evaluated a number of antecedent interventions for childhood feeding disorders and noted that the presence or absence of IMB seems to be related to the effectiveness of various antecedent interventions. Thus, it is possible that successful applications of the Hi P sequence, as well as other antecedent interventions, depend upon the presence or absence and severity of IMB. Indeed, successful applications of the Hi P sequence in the feeding literature have involved participants who do not engage IMB (e.g., Ewry & Fryling, 2016; Meier et al., 2012; Patel et al., 2007). The present study is consistent with this, as John engaged in very little IMB throughout the evaluation. Future researchers might consider assessing the impact of antecedent interventions both before and after IMB has been treated directly to better understand the relationship between intervention effectiveness and IMB.

More generally, future researchers should continue to explore less intrusive, antecedent interventions that can be used in the treatment of feeding problems with children with ASD. Indeed, there are a large number of individuals who might be considered "at risk" for developing more severe feeding problems, and antecedent interventions may be considered a means of preventing such problems from developing and improving overall health. Given this, less intrusive interventions, such as the Hi P sequence, warrant continued attention from both researchers and clinicians alike.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

RESEARCH ETHICS

This study was approved by the institutional review board, and informed consent was obtained prior to inclusion in the study.

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