Behavior Analysis in Practice (2023) 16:860–866
https://doi.org/10.1007/s40617-022-00771-z

RESEARCH ARTICLE

Use of a Preassessment to Inform Treatment of Rapid Eating

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Accepted: 13 December 2022 / Published online: 28 December 2022

Abstract
Rapid eating is a common and potentially dangerous behavior among individuals diagnosed with autism spectrum disorder (ASD; Favell et al. *Behavior Modification, 4*, 481–492, 1980). Although limited research has shown efficacy in treating rapid eating using procedures that increase interresponse time between bites, the literature on preassessment methods to inform treatment remains limited. Therefore, the purpose of the present study was to replicate and extend procedures used by Page et al. *Behavior Analysis in Practice, 10*, 87–91 (2016) to effectively reduce the rapid eating of an adolescent male diagnosed with ASD through the incorporation of a preassessment and treatment package including a vibrating pager, vocal rule, and response blocking. Overall, results of the study demonstrated that the preassessment was effective in determining foods to be included in treatment, and the treatment package was effective in increasing average interresponse time between bites. Additions to the current literature as well as limitations to be addressed in future research are discussed.

Keywords Autism spectrum disorder · Feeding disorder · Rapid eating · Vibrating pager

Rapid eating is a common and potentially dangerous behavior among individuals diagnosed with autism spectrum disorder (ASD; Favell et al., 1980). Rapid eating can lead to serious health consequences such as choking (Wright & Vollmer, 2002), vomiting, or aspiration (Kedesdy & Budd, 1998). In addition, rapid eating can be socially stigmatizing, limiting an individual's access to certain learning opportunities or environments (e.g., eating independently at restaurants; Favell et al.; Page et al., 2016). Although research on the application of behavioral interventions to rapid eating is limited, research does support the effective use of behavioral methods to address a variety of feeding related problems (Piazza et al., 2015).

Much of the prior research that has been conducted on rapid eating has typically employed interventions to lengthen the amount of time an individual takes between bites (i.e., interresponse time). Favell et al. (1980) evaluated the effects of programmed reinforcement for successively longer independent pausing between bites and systematic fading of physical prompts (e.g., blocking) when attempts to eat rapidly occurred. Results indicated the procedures were effective for reducing rapid eating for four individuals with intellectual disabilities. Lennox et al. (1987) compared the effects of three procedures: response interruption (e.g., blocking), a spaced-responding differential reinforcement of low rates (DRL) 15-s procedure, and a combined DRL procedure with prompting on reducing rapid eating for three individuals with developmental disabilities. The prompting component in one of the conditions involved the use of a graduated guidance procedure to prompt a competing response (i.e., putting the fork down following each bite). They found that the DRL with prompting procedure was effective for two participants to achieve a socially significant reduction in rapid eating. The experimenters were not able to identify an effective procedure for the final participant and the participant was withdrawn from the evaluation due to increases in problem behavior. The prompts used to teach the competing response in the DRL with prompting condition may have prevented the participant from engaging in subsequent attempts due to the added response effort as well as the timing of experimenter prompts to put the fork down; however, the response interruption condition may have increased responding due

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to intermittent reinforcement when the 15-s interval elapsed due to the ease of reattempting after blocking. In addition, it is unclear if the prompting may have served as a punisher for rapid eating whereas blocking may not have; that is, reattempts may not have decreased in the response interruption condition due to the ease of emitting the response as well as the potential reinforcement for persistence in engaging in further attempts. An important limitation to this study was that data were not collected on the frequency in which prompts or blocking were used, therefore, it is unclear whether or not there was a decrease in experimenter interactions or an overall increase in the percent of independent bites across sessions. Observed decreases in prompting may be significant in determining whether there were increased levels of independence that would subsequently remove the necessity for high levels of monitoring (i.e., supervision) typically required for this type of problem behavior. Wright and Vollmer (2002) extended procedures from Lennox et al. by comparing the use of an adjusting versus a fixed DRL schedule. Results of this study demonstrated that the use of an adjusting DRL procedure with prompts and blocking was effective in increasing bite IRT. Wright and Vollmer also demonstrated that although the treatment resulted in initial increases in problem behavior, rates decreased and remained low for the remainder of treatment.

More recent research has incorporated the use of a vibrating pager during treatment of rapid eating for individuals diagnosed with ASD (Anglesea et al., 2008; Echeverria & Miltenberger, 2013; Page et al., 2016; Valentino et al., 2018). The use of a vibrating pager may be a particularly beneficial treatment component because it can serve as a discrete prompt to the individual and may allow for fading the presence of another person or level of supervision during meals (Anglesea et al., 2008). For example, Anglesea et al. demonstrated that a treatment package comprised of prompting participants to take bites when the pager vibrated as well as blocking participants from taking bites when the pager had not vibrated was effective in increasing overall meal duration. The experimenters were also successful in fading their interactions for all participants as well as the presence of an adult altogether for one participant, showing the efficacy of pager prompts in increasing independence within mealtimes while maintaining treatment effects for rapid eating. Page et al. (2016) demonstrated the effects of a treatment package on reduction of rapid eating for an adolescent female with ASD. The researchers used a vibrating pager with a rule of when to eat and vocal prompts in the absence of response blocking, physical prompting, or programmed reinforcement. Results of their study showed that a vibrating pager with a rule alone was not sufficient to reduce the pace of eating, however, the pace of eating did decrease upon incorporation of a vocal prompt.

Although the previously mentioned studies provide some growing evidence for the effectiveness of behavioral methods in reducing rapid eating, the research remains limited and, to our knowledge, no study to date has incorporated any form of preassessment prior to a treatment evaluation. Assessment of variables that may affect a successful intervention has been a long-established practice in behavior analysis and demonstration of this as it applies to feeding disorders is a much-needed area of continued research. Inclusion of these assessments could be beneficial in informing treatment selection as well as making ongoing decisions throughout the treatment process. Therefore, the purpose of the present study was to replicate and extend procedures used by Page et al. (2016) to effectively reduce the rapid eating of an adolescent male diagnosed with ASD through the incorporation of a preassessment and treatment package including a vibrating pager, vocal rule, and response blocking.

Method

Participant and Setting

Kobi was a 13-year-old male diagnosed with ASD. He lived at home with his caregivers and siblings, and he attended a local school for individuals diagnosed with ASD in Ghana. At the time of the evaluation, he was being taught to use a picture-exchange system to communicate and was able to follow multistep instructions in both English and Twi. Both informal and formal mealtime observations indicated that he consumed meals at a rapid pace which often resulted in coughing due to the amount of food he attempted to swallow at one time. He also had a history of attempting to steal food when access to food was delayed or when in close proximity to other people's food. At the time of referral, caregivers expressed concern about his weight gain and safety concerns (e.g., choking) associated with the pace in which he ate meals. In addition, caregivers relayed that his meals at home were constantly supervised and they were not able to complete any concurrent activities (e.g., eating their own meals) while he was eating.

Sessions took place in a small, partitioned-off space within the school he attended. The room was approximately 8 x 5 ft. and contained a desk and chair. Sessions included typical materials to conduct a meal (e.g., plate, utensils, foods). A vibrating pager (i.e., MotivAider) was present during pager prompt and pager prompt + blocking sessions. Kobi had access to his water bottle across all phases. Sessions were conducted once per day during his regularly scheduled snack or lunch. Session length varied based on the amount of time it took him to consume the entire portion that was presented to him, but never exceeded 30 min.

Sessions would have been terminated had Kobi indicated he was done eating, but this did not occur during the treatment evaluation. Sessions began as soon as the food was placed in front of him and he took his first bite, and ended when he consumed the final bite of food.

Safety criteria were outlined due to the potential hazardous effects of rapid eating (e.g., choking). A CPR certified staff member was present during all sessions to monitor for risk and signs of choking (e.g., coughing while eating). Choking did not occur during the evaluation and emergency procedures were not required from the CPR-certified staff throughout the course of the study.

Dependent Measures

Data were collected on the frequency of acceptances and blocking during all conditions using a handheld electronic device with an app (i.e., Countee; Peic & Hernandez, 2015) that allowed tracking of total session length and the time at which each acceptance and block occurred. Acceptance was defined as a portion of food larger than the size of a pea crossing the plane of the lips and deposited into the mouth. Blocking occurred when the experimenter placed their arm between Kobi and the spoon or contacted Kobi's arm to prevent the premature acceptance of an additional bite. An instance of blocking was recorded each time the experimenter placed their arm between the torso and Kobi's arm, or when the experimenter made contact with the Kobi's forearm(s). Average IRT per session was determined using raw data produced by the Countee app (as described above) by calculating the total sum of bite IRTs (i.e., time between acceptance of one bite to the next) and dividing by the total number of acceptances. The percentage of independent bites (i.e., bites in which the blocking contingency was not met) was also calculated using raw data produced by the Countee app by counting the total number of acceptances in which blocking did not occur and dividing by the total number of acceptances multiplied by 100.

Interobserver Agreement

A second observer independently collected data during 37.5% of sessions. Interobserver agreement (IOA) was calculated for acceptances using the proportional method and for response blocks using the total count method. IOA was calculated for acceptances by dividing each session into 10-s intervals, dividing the smaller number of acceptances in each interval by the larger number of acceptances, and multiplying by 100. IOA was 91.4% (range: 69.2%–100%) for acceptances. IOA was calculated for response blocks by dividing the smaller frequency of response blocks in a session by the larger number of response blocks, and multiplied by 100. IOA was 92.5% (range: 85.7%–100%) for response blocks.

Preassessment

Prior to implementation of baseline sessions, an assessment was conducted to determine whether different types of food (e.g., fruit, rice dishes, Cerelac) resulted in a lower average IRT relative to other foods. The purpose of this assessment was to determine which foods would require intervention and, if any, foods that may not require intervention. A single type of food was presented at a time, as was standard for how these foods were consumed in Ghana, and data were collected on the frequency of acceptance such that average IRT given the specific food could be determined. Three assessment sessions were conducted for each food type and each session was 3 min. Snack foods (e.g., Cerelac, fruit, biscuits) were sent in by his caregivers and lunch foods (e.g., rice dishes) were prepared daily by the school cook according to a predetermined meal schedule. Experimenters collected data when targeted foods were naturally presented during scheduled mealtimes. The presented portions of food were determined by the school and typical for the food type (i.e., no programmed manipulations occurred). After presentation of the food, no prompts or interaction were provided. Safety was monitored as previously stated, but no programmed consequences were delivered contingent on acceptance of food or on the pace of eating.

Treatment Evaluation

An ABCBC reversal design was used to evaluate the effects of the pager and physical prompts (i.e., blocking) on the average interresponse time (IRT) of acceptance during meals.

Phase A (baseline) During initial baseline sessions, the researcher placed the meal on the table directly in front of Kobi. No vocal instructions were delivered and the vibrating pager was not present. No programmed consequences were delivered contingent on the pace of accepted bites.

Phase B (pager prompt) Pager prompt sessions were identical to initial baseline procedures with the exception of the presence of the vibrating pager set to repeat every 20 s and activated upon initiation of Kobi's first bite. The experimenter set the vibrating pager for 20-s intervals because previous research has indicated that 20 s may be an appropriate interval, particularly for individuals who take larger bites (Page et al., 2016).

Phase C (vocal rule, pager prompt, and blocking) Prior to the start of the session, the experimenter stood directly behind Kobi and out of immediate visual sight. When food was presented, the experimenter provided the vocal rule, "here's your food, when you take a bite, wait for the timer before you take another bite." The pager was set to repeat at 20-s

intervals and activated upon initiation of Kobi's first bite. If he attempted to take a bite prior to the interval elapsing, the experimenter blocked from behind the acceptance of an additional bite.

Results

Figure 1 displays the average bite IRT per food during the preassessment. The preassessment results indicated that rice dishes (e.g., red red, rice and fish, and fried rice) produced the lowest interresponse times (range: 12.3–19.8 s). Other foods assessed included fruit (e.g., watermelon, papaya), which had higher mean interresponse times (range: 40.2–45.7 s), and snacks (e.g., biscuits, Cerelac), which had mean IRTs approximating the appropriate 20-s criterion (range: 18.4–23.4 s). Rice dishes were targeted throughout the remainder of the study based on these results (i.e., all rice dishes produced average IRTs below the 20-s criterion) as well as anecdotal data and caregiver report indicating that safety concerns such as choking most often occurred during these meals. It is also important to mention that rice dishes were prepared daily by the school cook and although they may have included more than one food type, these dishes were prepared in a way such that each dish, overall, maintained similar texture and consistency.

Figure 2 displays average bite IRT across baseline, pager prompt, and pager prompt plus blocking phases. The average bite IRT across initial baseline sessions was 11.5 s (range: 9.1–14.1). Introduction of the vibrating pager during the pager prompt phase produced a slight increase in average bite IRT across sessions to 15.5 s (range: 13.2–18). When the vibrating pager, rule, and response blocking were introduced during the next phase, average bite IRT increased to an average of 25.7 s (range: 21–32.8). A reversal to the pager prompt condition demonstrated a replication of previous levels with an average of 15 s (range: 12.2–18.9). Reintroduction of the pager prompt plus blocking resulted in an increase in average bite IRT to 26.29 s (range: 22.9–31.7).

Figure 3 displays the percent of independent bites accepted across pager prompt plus blocking phases. The average percent of independent bites during the initial introduction of this phase was 61.8% (range: 29.2%–86.2%). Across the second introduction of the phase, the average percent of independent bites was 79% (range: 51.6%–94.9%). Overall, Figure 3 displays an increasing trend in the percentage of bites taken independently (i.e., without blocking).

Discussion

In this study, Kobi's pace of eating was targeted using a treatment package involving a vibrating pager, vocal rule, and response blocking on foods identified to be consumed rapidly in a preassessment. These results add to the current literature on rapid eating in several ways. Most significant, our novel inclusion of a preassessment allowed us to effectively determine high- and low-risk foods for Kobi. Establishing operations and other antecedent variables such as states of satiation or deprivation, effort to eat (e.g., chewing), as well as preference for types of food may impact the pace of eating. Our preassessment allowed us to isolate food type from its relation to the pace of eating to determine if bite IRT varied as a function of food type. This was of particular importance for the participant in the current evaluation who did show varying rates of eating across different foods. For example, fruits were described to be less preferred whereas rice dishes were said to be more preferred; although we did not conduct a formal preference assessment,

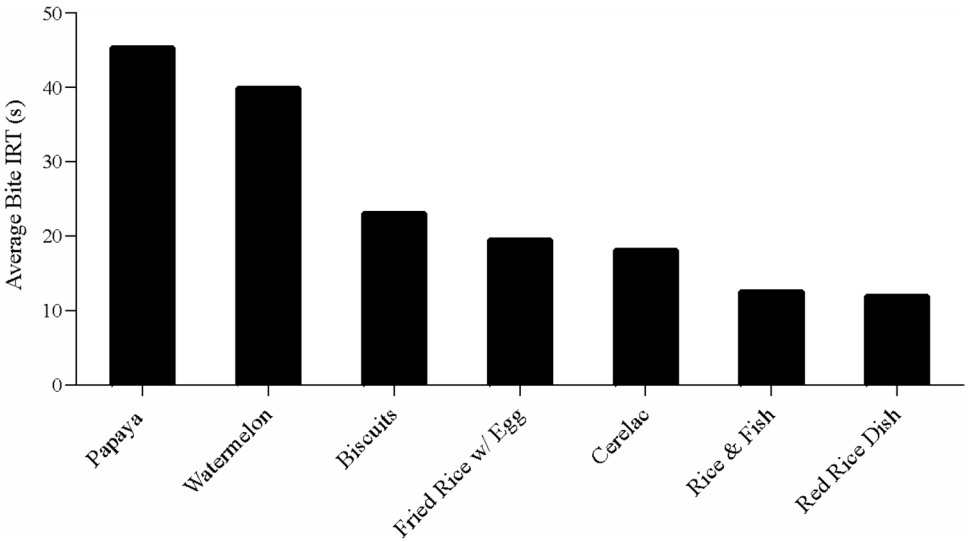

Fig. 1 Average Bite IRT in Seconds across Types of Foods during Preassessment Sessions

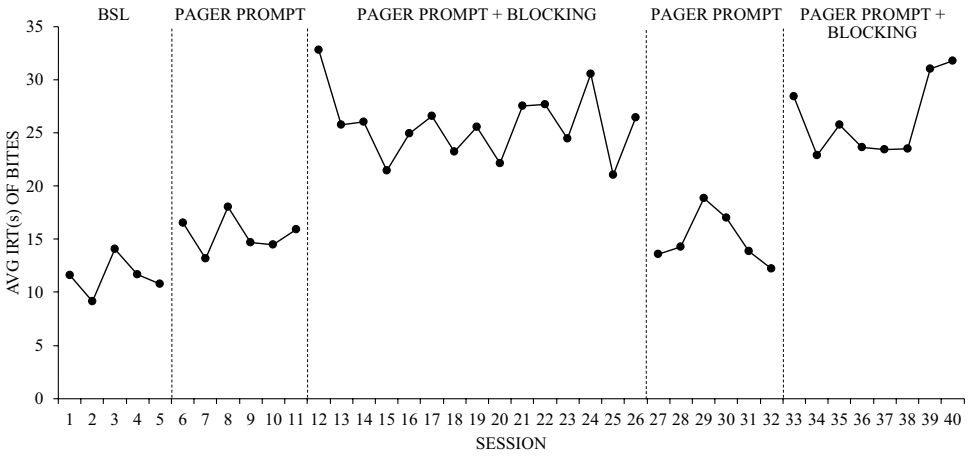

Fig. 2 Average Bite IRT across Baseline, Pager Prompt, and Pager Prompt + Blocking Phases

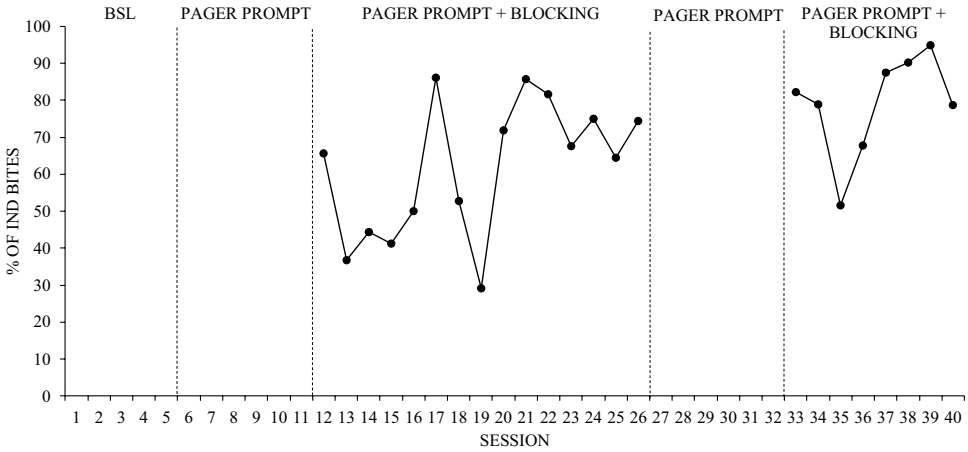

Fig. 3 Percent of Independent Bites across Pager Prompt + Blocking Phases

because preference was not related to the research question, differential bite IRTs were observed across these two food types. Identification and isolation for intervention of higher preference foods may be an important and necessary component when intervening on rapid eating. Inclusion of this type of assessment in the treatment of rapid eating could allow for prioritization of foods that require intervention (shorter IRTs). In addition, the preassessment may identify foods that could be incorporated into treatment recommendations (longer IRTs) when levels of supervision or other treatment variables cannot be reliably implemented (i.e., prevention). The results of the preassessment could guide recommendations for possible antecedent manipulations (i.e., diet manipulations) when, for example, under times in which supervision would be difficult, the recommendation might be to provide foods that are of lower risk such as those directly observed to have longer IRTs. For example, foods with longer IRTs could be used when supervision of the individual's eating is not possible in order to ensure safety through prevention of choking and other rapid eating related hazards (e.g., aspiration). Foods with shorter IRTs could also be used to inform methods of treatment for rapid eating that have yet to be evaluated such as blending or simultaneously presenting (e.g., mixing or pairing) these foods with foods known to result in longer IRTs. In the current study, rice dishes were presented alone as this was standard for meal preparation and consumption in Ghanian culture. However, this may be a particularly important area for future research in cultures in which it is customary to present multiple types of foods together in the same meal. Once effective, fading procedures in which foods with longer IRTs are introduced with those with shorter IRT could then be systematically evaluated.

In the study conducted by Page et al. (2016), effects of the pager and rule were evaluated in combination. Our study isolated the pager prompt to demonstrate that the pager alone did not decrease the pace of eating to the 20-s criterion. Although the vibrating pager did increase the overall IRT above initial baseline (pager absent) levels, it did not increase to an acceptable IRT without the addition of blocking. Overall, these results replicated findings of previous research and demonstrated blocking was an active component of the treatment package in decreasing the pace of eating in a school setting. Even though Page et al. did not use

physical guidance or blocking, their use of a verbal prompt to interrupt bites taken before the 20-s criteria suggests that blocking and verbal prompts may function in similar ways to transfer control from the experimenter's interaction to the vibrating pager.

It is possible that the blocking component aided in the transfer of stimulus control to the vibrating pager. For example, Anglesea et al. (2008) used blocking to effectively establish stimulus control over the prompt (i.e., vibrating pager) to reduce rapid eating. This study, along with our results, may indicate that blocking may function initially as a prompt as to when it is appropriate to take the next bite as well as, when faded, transfer control of eating to the pager. Future research may wish to address questions about efficiency and efficacy of the use of blocking to transfer control over to the pager prompt and best possible procedures (e.g., most-to-least prompting and fading) to achieve these outcomes. In addition, the training procedures used by Anglesea et al. could be combined with the current procedures in an attempt to fade the use of blocking much more rapidly.

Although blocking seems to have been a necessary component in the current evaluation as well as previous research, Lennox et al. (1987) found blocking alone to be ineffective. However, bite IRT did increase to socially appropriate levels when blocking was combined with a competing response (i.e., putting the fork down after each bite). However, this intervention may not have been effective in increasing independence (i.e., reducing the frequency in which physical prompting was required) as those data were not included. This study is an additional indicator of the necessity of physical intervention (e.g., physical prompting, blocking, redirection) in order to effectively reduce rapid eating. Determining the exact physical components required for reducing rapid eating has yet to be examined, but may be significant in determining precise participant characteristics under which these procedures may or may not be effective. This is especially interesting because Page et al. (2016) were able to identify a nonphysical way of interrupting (i.e., verbal prompt) that remained effective for their participant. Furthermore, identifying procedures to systematically remove physical interactions and/or reduce the time intensiveness of these procedures has been largely unaddressed, but remains an important area of future study.

Several limitations of the present study are important to consider. First, although direct observation and caregiver report indicated that coughing often occurred, particularly during rice-based meals, no direct measures were taken. Because safety is a primary concern for rapid eating, inclusion of this measure, particularly during the preassessment, will be an important variable to demonstrate not only a reduction in the pace of eating but the hazardous side effects of rapid eating as well. Our data does not allow us to draw any conclusions in this area, however, it is our recommendation that future researchers and clinicians include coughing as a measure or other appropriate measures that might aid in their decision making in assessing and intervening on rapid eating.

Second, although an increasing trend in the percentage of independent bites was observed in the second phase of our intervention, blocking was still a necessary component of the treatment package when treatment halted. It is possible the presence of others may have influenced bite IRT and our successful intervention. Caregivers and school staff had previously reported that Kobi was reactive to others being present while he was eating, therefore, the initial goal of the study was to design an intervention that would be sustainable in the absence of ongoing supervision (i.e., a target reduction in frequency of response blocking to zero); thus, we attempted to minimize reactivity by having the experimenter stand behind Kobi during his sessions. However, continuation of the intervention, potential follow-up phases, and caregiver training were unable to be conducted as a result of school closures due to COVID-19 and a lack of access to telehealth services. In addition, it is unclear whether the percent of independent bites would have remained high or if an additional component would have been required. We are also unable to identify whether or not the observed decrease in bite IRT was a function of punishment, a transfer of stimulus control to the vibrating pager through negative reinforcement, or a combination of both processes. Future research may wish to address these questions and evaluate the function of response blocking for participants prior to their use in interventions.

A third limitation in the study was our use of a treatment package involving multiple components implemented simultaneously. That is, we added a vocal rule with the blocking component and did not independently evaluate the rule itself. Thus, it is unclear if the vocal rule alone or vocal rule with the pager prompt would have resulted in reduced rates of eating. Given Kobi's pattern of responding, it seems unlikely that the addition of the vocal rule had any effect in that frequent use of response blocking occurred during this phase; that is, rapid eating seems like it would have been likely without the use of a physical intervention; however, it may be important for future researchers to assess compliance with vocal instructions or other forms of interrupting alone to determine if this type of intervention would be effective without the use of blocking. In addition, blocking seemed to be an active variable in increasing bite IRT in that when it was removed, bite IRT decreased again; thus, the vocal rule itself seemingly had no effect during the reversal phase seeing as bite IRT reversed back to previous levels. However, future research should determine the effects of rules within similar contexts as well as prerequisite skills or

under what conditions they may be advantageous. In addition, consuming large bite sizes were observed to be problematic for Kobi and are a potentially dangerous factor in rapid eating; however, we did not include a measure of bite size, therefore, conclusions cannot be made on whether the treatment package was effective in reducing bite size in addition to increasing IRT. Future research may wish to either control or measure bite size and meal size from a measurement standpoint. Despite the limitations cited here, this study successfully evaluated the use of a pre-intervention assessment to identify factors (e.g., food type) that influenced bite IRT and an intervention to treat rapid eating for a child in a school setting.

Author Contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Cassie O'Hara, Akanksha Chhettri, Beatrice Fosua and Jonathan Fernand. The first draft of the manuscript was written by Cassie O'Hara and Jonathan Fernand commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of Interest The authors declare that they have 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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