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FUNCTIONAL ANALYSIS AND TREATMENT OF RUMINATION USING FIXED-TIME DELIVERY OF A FLAVOR SPRAY

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A functional analysis suggested that rumination exhibited by an adult with autism was maintained by automatic reinforcement. Next, a preference assessment with three flavor sprays (i.e., flavored sprays used by dieters) showed that apple pie spray was most preferred. Finally, the effects of fixed-time delivery of the apple pie spray on levels of rumination were evaluated. The spray reduced rumination, and the participant was taught to self-administer the spray.

DESCRIPTORS: fixed-time schedule, flavor spray, functional analysis, rumination

Rumination is the regurgitation, chewing, and reswallowing of previously ingested food and can result in malnutrition, esophagitis, tooth decay, and social problems due to malodorous breath (American Psychiatric Association, 1994). Rumination has been estimated to occur in about 10% of institutionalized individuals with developmental disabilities (Rogers, Stratton, Victor, Kennedy, & Andreas, 1992). Although in some cases rumination may result from a medical condition (e.g., gastrointestinal disorder), rumination may also be an operant behavior (Lyons, Rue, Luiselli, & DiGennaro, 2007).

Research has identified a number of antecedent-based interventions for rumination that involve manipulating access to food or liquid. The most common intervention involves increasing intake in an attempt to abolish the putative reinforcer for rumination. For example, Rast, Johnston, Drum, and Conrin (1981) attempted to produce satiation by providing larger quantities of food at meals. Similarly, Wilder, Draper, Williams, and Higbee (1997) delivered frequent small amounts of food on a fixed-time (FT) schedule after meals. An alternative approach involves restricting or eliminating access to liquids for some time before, during, or after a meal in order to decrease the opportunity for rumination (Heering, Wilder, & Ladd, 2003). In addition to being effective, antecedent-based food-related treatments are particularly easy to implement and are often more socially acceptable than punishment-based interventions.

The purpose of the current study was to evaluate an alternative antecedent-based intervention for rumination that may have advantages over food-based treatments. Specifically, we evaluated the fixed-time delivery of a flavor spray for the treatment of rumination maintained by automatic reinforcement. Flavor sprays may be more advantageous than food for a number of reasons. First, flavor sprays have no calories, making them an attractive option

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for individuals who are on a strict diet. Second, flavor sprays are less costly than many foods. Finally, flavor sprays do not spoil; many foods must be purchased on a regular basis to ensure that individuals consume fresh or unspoiled food.

METHOD

Participant and Setting

Dillon was a 37-year-old man with autism and profound mental retardation. He used a few signs to communicate; his vocal language skills were limited to a small number of poorly articulated mands. Staff reported that Dillon had a 15-year history of rumination after eating meals. He had experienced some minor dental problems, but was otherwise healthy. At the time of the study, Dillon was on 4 mg of Risperdal and 1 mg of Klonopin per day. His weight was in the normal range for his height. Sessions were conducted in a small therapy room at the center where Dillon resided. Two sessions were conducted per day, 1 to 2 days per week.

Response Measurement and Definitions

Data collectors recorded the frequency of rumination on a data sheet, which was partitioned into 10-s intervals for purposes of assessing interobserver agreement. On all days on which data were collected, Dillon was served a lunch consisting of one beef patty, one small bag of potato chips, one small mixed fruit cup, and 237 ml of fruit juice. Rumination was defined as an upward movement of the throat and then an immediate swishing of the tongue, which produced a visible indentation on the cheeks. During the intervention evaluation, when Dillon received the flavor spray, a therapist squirted one spray into his open mouth. The duration of the flavor spray administration was very brief (i.e., about 1 s), and it was possible for Dillon to engage in rumination during administration of the spray. A second independent observer recorded rumination during at least 32% of sessions across the functional analysis and the treatment evaluation. Interobserver agreement was obtained by comparing the smaller number of events by the larger number of events during each 10-s interval. The mean of the quotients for each interval was then obtained and converted to a percentage. Mean interobserver agreement was 81% (range, 70% to 100%) for the functional analysis and 83% (range, 70% to 95%) for the treatment evaluation.

Procedure

Functional analysis. Dillon was exposed to four experimental conditions in a multielement design to determine the variables that maintained his rumination (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). Because he could not be left alone, a no-interaction condition was used instead of an alone condition. In this condition, a therapist was present in the room with Dillon, but did not interact with him. In the attention condition, the therapist provided brief attention contingent on rumination, but otherwise ignored Dillon. In the demand condition, the therapist used a three-step prompting sequence to continuously present demands to Dillon. Contingent on rumination, he received a 30-s break. During the control condition, Dillon had access to preferred items (i.e., strings), and the therapist provided attention on an FT 15-s schedule. All conditions were 10 min in duration, and each condition was conducted both before and after lunch to determine if contingency manipulation might have a different effect on rumination pre- and postmeal (Bloom & Iwata, 2008). Two conditions were conducted per day (one before and one after the meal). To enhance discrimination among conditions, a different therapist was assigned to each of the four conditions (Conners et al., 2000). In addition, each therapist wore a specific colored shirt. All sessions were separated by at least 5 min.

Stimulus preference assessment. A modified multiple-stimulus with replacement preference assessment (Windsor, Piche, & Locke, 1994) was conducted to assess Dillon's preference for three flavor sprays (apple pie, birthday cake, and barbecue). Flavor sprays are fat-free, calorie-free liquid sprays that are marketed to dieters. These three flavors were chosen because staff reported that Dillon preferred them.

For the preference assessment, three identical chairs were arranged in a semicircle; the flavor sprays were placed next to the chairs. Prior to the start of the assessment, Dillon was prompted to sit in each chair and was then immediately given five squirts of the corresponding flavor spray. Each spray was associated with only one of the three chairs. At the beginning of each trial during the preference assessment, Dillon was guided to stand in a neutral area equidistant to all three chairs and prompted by the therapist to "Choose a chair and flavor." When Dillon independently sat in one of the three chairs, he immediately received one squirt of the flavor spray associated with that chair. To reduce the potential impact of position bias, the chairs were rearranged after 14 trials, at which point Dillon was reexposed to the training procedure described above. A total of 28 trials were conducted. Each trial took approximately 30 s to conduct, with short breaks between trials. The preference assessment was conducted in 30-min blocks across 3 days.

Intervention evaluation. During the intervention evaluation, sessions were 10 min in duration and occurred immediately after lunch. Only two sessions were conducted per day because a measure taken before the functional analysis showed that rumination occurred at stable rates for 25 min after a meal but then began to decline. The effects of the FT delivery of the apple pie spray were evaluated in a reversal design. Baseline sessions were identical to the no-interaction condition of the functional analysis. During apple pie spray FT 20 s, a therapist provided Dillon with one squirt of the spray every 20 s, independent of rumination. Because the FT 20-s schedule did not eliminate rumination, an FT 2-s schedule of the spray was applied. The schedule was then thinned to FT 10 s in an effort to identify a schedule that was practical for staff to implement. Finally, Dillon was taught to self-administer the spray on an FT 10-s schedule. To do this, a tone was programmed to sound every 10 s. Dillon was prompted (using verbal, gestural, and physical prompts) to squirt the flavor spray into his mouth each time the tone sounded. These prompts were faded over time. (Training data are not depicted in Figure 1.)

RESULTS AND DISCUSSION

Dillon displayed elevated rates of rumination across all postmeal conditions of the functional analysis and did not engage in rumination during any of the premeal conditions of the functional analysis (Figure 1). These results suggest that Dillon's rumination was maintained by automatic reinforcement. Because the specific source of automatic reinforcement was not identified and therefore could not be manipulated, an intervention hypothesized to provide a form of oral stimulation (i.e., FT delivery of a flavor spray) was used. During the stimulus preference assessment, Dillon chose the apple pie spray on 86% of trials, the birthday cake spray on 14% of trials, and he never chose the barbecue spray (Figure 1, middle).

During the initial baseline, Dillon exhibited a mean of 2.8 ruminations per minute. During the first apple pie spray FT 20-s condition, he exhibited a mean of 1.2 ruminations per minute. During the next baseline, he exhibited a mean of 3.7 ruminations per minute. During the second apple pie spray FT 20-s condition, he exhibited a mean of 1.0 rumination per minute. In an effort to further decrease

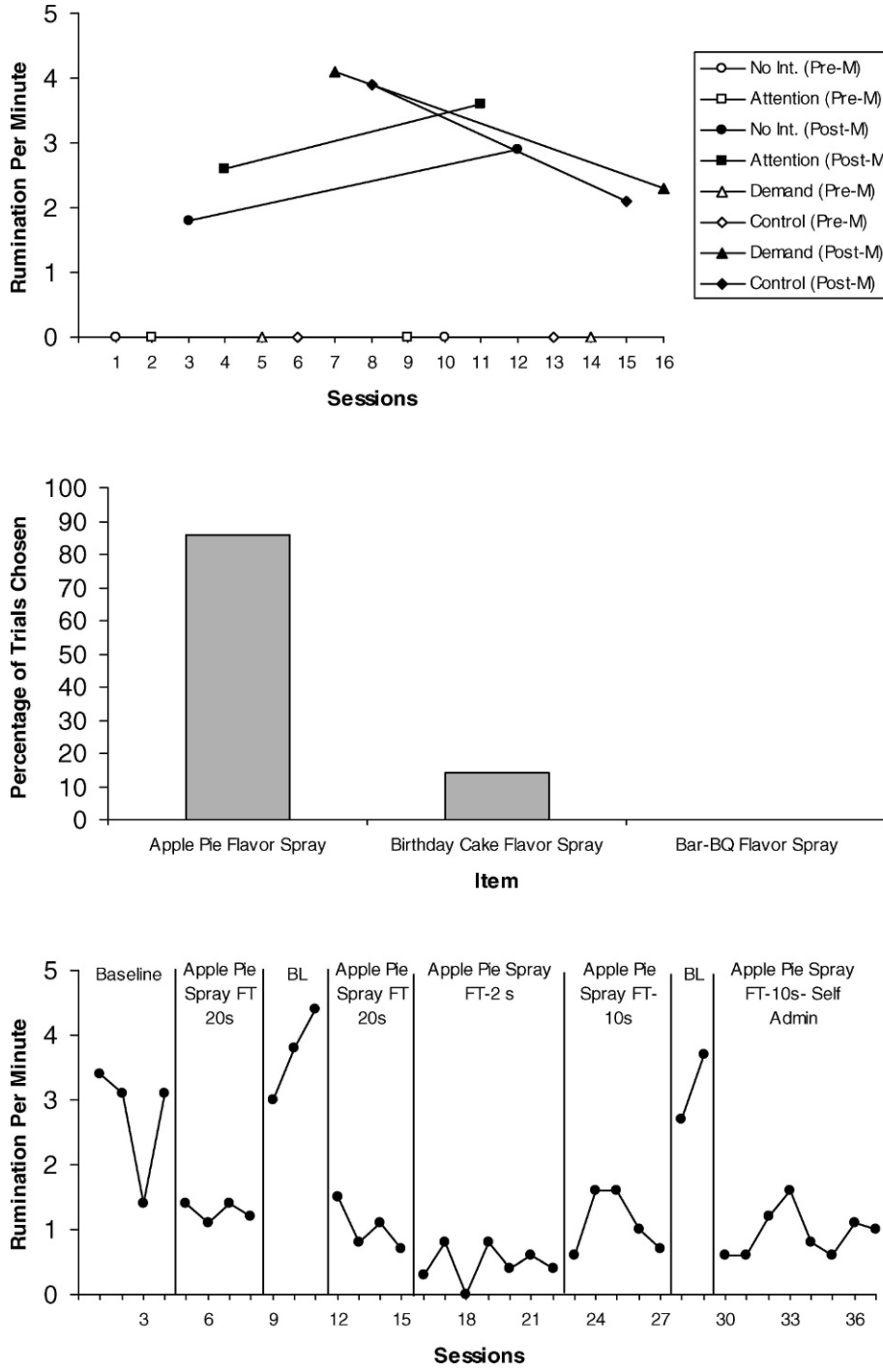

Figure 1. Rumination per minute (pre- and postmeal) across the conditions of the functional analysis (top); percentage of trials in which each flavor spray was chosen during the stimulus preference assessment (middle); Rumination per minute across baseline and treatment conditions of the intervention (bottom).

rumination, the schedule was increased to FT 2 s. Dillon's mean rate of rumination during this phase was 0.47 per minute. Thinning the FT schedule was then attempted; during the FT 10-s schedule, his mean rate of rumination was 1.1 per minute. After a brief return to baseline, in which he engaged in a mean of 3.2 instances of rumination per minute, he was taught to self-administer the flavor spray. During the FT-10 s self-administration phase, Dillon engaged in a mean of 0.93 instances of rumination per minute. Staff at Dillon's day program were then asked to implement the intervention after meals by monitoring Dillon to ensure that he self-administered the spray according to the FT schedule.

The results of this study suggest that the FT delivery of flavor sprays can reduce rumination in adults with developmental disabilities. Although previous research (Rast et al., 1981; Wilder et al., 1997) has shown that food satiation and the FT delivery of food can also reduce rumination, flavor sprays may be more advantageous because they are calorie free, inexpensive, and do not spoil. It should be noted, however, that additional components may be necessary to reduce rumination to clinically acceptable levels. Although Dillon's rate of rumination at the conclusion of treatment (approximately 1 per minute) was reduced relative to baseline, this rate may not be considered clinically acceptable, and the dense schedule (FT 10 s) of spray administration may make this intervention impractical in some settings.

The operant processes responsible for the effects of the flavor spray are unknown. If the variable that maintained rumination was the taste of regurgitated food, the flavor spray could have served the same function. On the other hand, the flavor spray may have competed with rumination in that consumption of the spray involved responses incompatible with rumination (although it was possible for Dillon to ruminate while simultaneously opening his mouth to receive and consume the spray). Finally, it is possible that the spray competed with rumination in another sense; it may have altered or reduced the reinforcing effects produced by rumination in some way. That is, the taste of the spray may have made the taste of rumination or some other sensation produced by rumination less preferred or perhaps even aversive.

Future research should examine the effects of flavor sprays on rumination with additional participants and using different schedules (e.g., differential reinforcement of other behavior). Also, in the current study, intervention included one flavor spray selected based on participant preference. Future research might determine whether intervention effects are enhanced by the inclusion of flavors matched to commonly regurgitated foods.

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