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Immediate and distal effects of supplemental food and fluid delivery on rumination

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ABSTRACT

Rumination is the repeated regurgitation, chewing, and re-swallowing of previously swallowed food. Several recent studies have examined the utility of supplemental feeding as a treatment for rumination including the delivery of foods and fluids. Results of these studies have been mixed, and the distal effects of these treatments are unclear. In this study, we compared the immediate and distal effects of fixed-time (FT) food and fluid delivery with baseline levels of rumination. We found no immediate or distal effects for FT 30-s fluid delivery. Food delivery on an FT 30-s schedule resulted in slightly lower levels of rumination during food delivery; however, rumination increased relative to baseline upon termination of food delivery.

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1. Introduction

Rumination involves the repeated regurgitation and re-swallowing (or spitting out) of partially digested food (American Psychiatric Association, 2013) and is displayed by as many as 10% of individuals with intellectual disabilities (Rogers, Stratton, Victor, Kennedy & Andreas, 1992). Rumination is associated with a variety of health risks including tooth decay, weight loss, malnutrition, and esophageal erosion and can be socially ostracizing (Rast, Johnston, Drum, & Conrin, 1981; Singh, Manning, & Angell, 1982). Rumination can be caused by medical issues such as gastroesophageal reflux but can also present as a form of operant behavior. That is to say, there are cases in which purely medical or biological explanations of rumination can be ruled out, and rumination can then be treated as a behavioral problem.

In such cases, rumination occurs most frequently following meals (Ellis & Schnoes, 2009) and is most commonly maintained by automatic reinforcement (Lyons, Rue, Luiselli, & DiGennaro, 2007; Wilder et al., 2009; Woods, Luiselli, & Tomassone, 2013). Those presumed reinforcers include automatic positive reinforcement associated with the stimulation generated to the gastrointestinal tract and mouth or automatic negative reinforcement associated with relief of bloating or discomfort in the stomach. Given that researchers are unclear regarding the specific operant cause of rumination, it is not surprising that most early treatment studies relied on delivering aversive stimulation contingent upon rumination to reduce the behavior (Cunningham & Linscheid, 1976; Lang & Melamed, 1969; Libet, Sajwaj, & Agras, 1973; Luckey, Waton, & Musick, 1968; Marholin, Luiselli, Robinson, & Lott, 1980; Singh et al., 1982; White & Taylor, 1967). For instance, Sajwaj, Libet, and Agras (1974) reported administering contingent lemon juice in the mouth and Foxx, Snyder, and Schroeder (1979)

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reported contingent teeth brushing with antiseptic solutions. Both studies demonstrated clinically significant reductions in rumination.

More recent research has reported on the successful treatment of rumination using non-aversive alternatives, including supplemental feeding (e.g., Dudley, Johnson, & Barnes, 2002; Kenzer & Wallace, 2007; Masalsky & Luiselli, 1998; Thibadeau, Blew, Reedy, & Luiselli, 1999; Wilder, Draper, Williams, & Higbee, 1997). Supplemental feeding is a procedure in which a therapist delivers a small amount of a preferred food or fluid on a fixed-time (FT) schedule following mealtime. This treatment is thought to be effective because it provides an alternative form of stimulation to the mouth and GI tract and thus competes with rumination. Alternatively, supplemental feeding with food may reduce rumination because the supplemental food absorbs digestive fluids in the stomach and increases the response effort associated with ruminating (i.e., it is more challenging to bring up solids relative to liquids). Both of these explanations are conjecture based upon the observed effects of the intervention. Although supplemental feeding has been demonstrated to reduce rumination in a number of studies, there are several unanswered questions.

First, the normative duration of ruminative episodes following meals is unknown. Once all the food in the stomach is digested (i.e., passes through the stomach), the opportunity to engage in rumination should be eliminated or greatly minimized. Thus, it should not be necessary to provide supplemental foods into perpetuity but rather for a limited period following a meal. However, the typical duration of rumination following a meal is unclear. Second, it is not clear what foods should be delivered during supplemental-feeding periods. To the extent that supplemental feeding realizes its effects by providing absorptive material into the stomach, then providing solid, absorptive food such as breads should be more effective than providing fluids; although some previous literature has shown supplemental feeding with fluids to be an effective intervention (Kliebert & Tiger, 2011). No study to date has systematically compared supplemental feeding with solids and fluids. Third, demonstrations of the reductive effects of supplemental feeding have typically involved measuring rumination for a fixed-time period following a meal, ending data collection once the supplemental-feeding period expires. However, it stands to reason that rumination may begin after this period if the relevant establishing operation for the reinforcer remains in place. Said another way, if supplemental feeding derives its effectiveness by providing alternative forms of oral stimulation, one could imagine that rumination would likely resume following supplemental feeding (i.e., when the alternative oral stimulation is no longer delivered). Further, the continued delivery of food or fluids will increase the stomach contents, thereby increasing the opportunity for continued rumination.

Kliebert and Tiger (2011) offered a preliminary evaluation as to whether supplemental feeding resulted in a delayed onset of rumination with a young boy with mental retardation. In this study, the experimenters conducted observations immediately following the child's meal time at school. On supplemental feeding days, the experimenters provided a sip of apple juice (a preferred fluid) on an FT-15 s schedule for up to 15 min and measured rumination both during supplemental-feeding periods and for an additional 15 min following the supplemental-feeding period. These data showed that rumination decreased while fluids were being delivered but increased to near-baseline levels when supplemental feeding was terminated. This suggests that rather than suppressing rumination, supplemental feeding may simply delay its onset.

Kliebert and Tiger (2011) was limited in several regards. First, they conducted their evaluation with a single child, and thus additional replications are necessary to determine the generality of this phenomenon. Second, this study involved the use of supplemental fluids only, so it is unclear if supplemental solids would have similar delayed effects. Third, the post-meal supplemental-feeding periods (15 min) and subsequent observation periods (15 min) were relatively brief. It is possible that extended supplemental-feeding periods would permit greater digestion and thus further minimize the opportunity for rumination, but it is unclear what the ideal duration of supplemental feeding should be.

The current study was designed to address these limitations associated with Kliebert and Tiger (2011) specifically and the body of rumination research more generally. We began by conducting a naturalistic observation of rumination with a child diagnosed with autism to determine the typical onset and duration of rumination following a meal. We then compared the immediate and delayed effects of supplemental feeding with both solid foods and fluids to determine both the immediate and distal effects of this intervention.

2. Method

2.1. Participant and setting

Andy was a 9-year-old boy diagnosed with autism spectrum disorder by a physician unaffiliated with this research team. Per his family report, Andy began engaging in rumination when he was approximately 1 year old, and his physicians had failed to identify any medical cause for his rumination prior to referring him to our program. Andy had experienced significant tooth decay and halitosis resulting from this behavior and was taking 40 mg of pantoprazole, a proton pump inhibitor, twice daily. Andy ate a limited-food diet due to selectivity. His meals typically involved pizza, chicken nuggets, French fries, or SpaghettiOs™, accompanied by orange juice or lemonade. We did not make any attempt to control the content of Andy's meals during this study.

We conducted sessions in Andy's home immediately following his evening meal, which was served at approximately 4:00 p.m. daily. Observation began when he walked away from his meal. During observations, he worked with an in-home aide not affiliated with this research team on social, play, and motor skills; these activities comprised his typical routine.

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