The ability to forgo an immediate pleasurable reward (delicious, unhealthy food) for a postponed benefit (weight loss) has been shown to be related to various types of health-related behaviors including obesity (1). Recent research has begun to focus on the ability to delay gratification and obesity in children. While results have been mixed, some studies show overweight and obese children are more impulsive and less able to delay gratification than healthy weight (HW) children (2–4).

Several cross-sectional studies have found that obese children are more impulsive than HW children (3,5). However, evidence is mixed regarding whether obese children’s difficulties delaying gratification apply specifically to edible rewards (2) or apply more generally to all types of rewards (4). Some studies have relied on adolescent self-report or parent report of self-control. These longitudinal studies indicate that children with more self-control, tend to remain leaner in the transition to adolescence (6–8). Another study examined the ability to delay gratification using the classic Mischel test (9). Results showed that difficulty delaying gratification at age 4 was associated with an increased risk of being overweight at age 11 (10). Furthermore, self-regulation skills as early as 2 years of age can predict the risk for becoming overweight or obese at age 5 (11).

Researchers are now examining the ability to delay gratification in relationship to success in obesity interventions. Although one longitudinal study showed that increased impulsivity is associated with less weight loss (5) another found the opposite (12).

However, none of these studies have used natural, ecologically valid measures of delayed gratification. More research is needed to clarify the relationship between delayed gratification and obesity. The current study fills this gap by using a retrospective review of an ecologically valid measure of delayed gratification of nonedible rewards to test the hypothesis that preadolescents with higher BMI would be less likely to delay gratification.

**METHODS**

Healthy Hawks is a 12-week educational/behavioral obesity intervention at the University of Kansas Medical Center. A major emphasis of the program is on goal setting and incentives. Target participants (obese/overweight children) attend the program along with at least one parent and typically at least one sibling. Each week, children earn a point if they complete their goals worksheet. They can spend that point immediately on a small toy prize or save points to use on a larger prize. We retrospectively calculated the percentage of points saved over the 12 weeks for 59 children (28 females) ages 8–12 years old (mean = 10.29 ± 1.39). Spearman correlation revealed that higher BMI percentile was associated with reduced point savings ($r = 0.33, P = 0.01$). Similarly, obese preadolescents saved significantly fewer points than healthy weight (HW) and overweight preadolescents ($t(57) = 3.14, P < 0.01$). Results from our ecologically valid measure support the theory that obese children are less likely to delay gratification than overweight and HW children. Even for nonfood rewards, preadolescent children with higher BMIs prefer the immediate reward over a delayed, larger reward. This has implications for developing specific strategies within obesity treatments aimed at improving delayed gratification.
We retrospectively calculated the percentage of points saved over the 12 weeks for 59 children (28 females; 47%) ages 8–12 years old (mean = 10.29 ± 1.39). Ethnic demographics of the children were 33 Hispanic (56%), 10 African-American (17%), and 16 white/non-Hispanic (27%). The majority of the children were obese (73%) (defined as BMI percentile >95%), while 27% were in the overweight (BMI percentile between 85–95%) or HW (BMI% <85%) categories. Overall, the mean BMI percentile was 92.58% ± 14.32, range 29.3–99.9. As attendance is rarely perfect, the percentage of points saved was based on the number of opportunities to save (number of sessions attended). The mean number of sessions attended for these participants was eight sessions out of 12 ± 2.5.

RESULTS
Spearman correlation revealed that higher BMI percentile at the beginning of the obesity intervention was associated with reduced point savings \( (r = -0.30, P = 0.01) \). Similarly, when grouped into categories, obese preadolescents saved significantly fewer points than HW and overweight preadolescents combined \( (t (57) = 3.14, P < 0.01) \). BMI percentile at the end of the intervention was also correlated with percentage of points saved \( (r = -0.27, P = 0.05) \). However, the amount of BMI change during the intervention was not correlated with percentage of points saved. This is likely due to the limited BMI change in 12 weeks (mean BMI change = −0.05 ± 1.14).

DISCUSSION
In this study of preadolescents, BMI was significantly associated with the ability to delay gratification using a naturalistic, ecologically valid measure. Children with higher BMIs saved less, and spent more of the incentive “points” earned during the obesity intervention. Results from our ecologically valid measure of delayed gratification support other studies showing that obese children are less likely to delay gratification than HW children (4,5). None of the prizes or incentives in our obesity intervention were food related. Therefore, even for nonfood rewards, preadolescent children with higher BMIs preferred the immediate smaller reward over a delayed, larger reward.

One limitation of this study is the short duration of the obesity intervention. Because 12 weeks is so brief, any resulting change in BMI due to the intervention had not manifested. Future studies should follow up with children several times postintervention to examine any relationship between points saved and BMI change.

This study adds to the literature focusing on the ability to delay gratification and obesity in children. An ecologically valid measure of delayed gratification is strong evidence that even for nonfood-related incentives, obese children are not as able to delay gratification as overweight and HW children. As studies have shown the ability to delay gratification can be modified (13,14), this has intriguing implications for obesity interventions. It may be worthwhile to include strategies that help children learn to better delay gratification.

DISCLOSURE
The authors declared no conflict of interest.

REFERENCES