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Research report

Can't wait to lose weight? Characterizing temporal discounting parameters for weight-loss [☆]Seung-Lark Lim ^{a,*}, Amanda S. Bruce ^{b,c}^a Department of Psychology, University of Missouri – Kansas City, 5030 Cherry Street, Kansas City, MO 64110, USA^b Department of Pediatrics, University of Kansas Medical Center, USA^c Center for Children's Healthy Lifestyles and Nutrition, Children's Mercy Hospital, USA

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ABSTRACT

Obesity is often related to steeper temporal discounting, that is, higher decision impulsivity for immediate rewards over delayed rewards. However, previous studies have measured temporal discounting parameters through monetary rewards. The aim of this study was to develop a temporal discounting measure based on weight-loss rewards, which may help to understand decision-making mechanisms more closely related to body weight regulation. After having their heights and weights measured, healthy young adults completed the Monetary Choice Questionnaire (MCQ), and an adapted version of the MCQ, with weight-loss as a reward. Participants also completed self-reports that measure obesity-related cognitive variables. For 42 participants who expressed a desire to lose weight, weight-loss rewards were discounted over time and had a positive correlation with temporal discounting for monetary rewards. Higher temporal discounting for weight loss rewards (i.e., preference for immediate weight loss) showed correlations with beliefs that obesity is under obese persons' control and largely due to lack of willpower, while temporal discounting parameters for monetary rewards did not. Taken together, our weight loss temporal discounting measure demonstrated both convergent and divergent validity, which can be utilized for future obesity research and interventions.

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Introduction

Temporal discounting, also called delay discounting, is present in humans and animals, and it indicates preference for a smaller, sooner reward versus a larger, later reward (Critchfield & Kollins, 2001; Galtress, Garcia, & Kirkpatrick, 2012). Higher or steeper temporal discounting of delayed reward is often thought to represent individual's *impulsivity* or *temporal myopia* of decision-making (Green & Myerson, 2013). Intuitively, the ability to forego an immediate pleasurable reward for a postponed benefit should be related to self-controlled decisions and health outcomes such as eating behavior and obesity (Epstein, Salvy, Carr, Dearing, & Bickel, 2010). For example, to maintain a healthy body-weight we must often resist the temptation for immediate pleasure from delicious but calorically-dense treats. Indeed, scientific evidence is accumulating for the strong relation between temporal discounting and body mass. People carrying excess body weight, meaning those of greater body mass

index (BMI), are more likely to choose smaller, more immediate monetary rewards (Bickel et al., 2014; Borghans & Golsteyn, 2006; Ikeda, Kang, & Ohtake, 2010; Jarmolowicz et al., 2014; Weller, Cook, Avsar, & Cox, 2008).

Individual differences in temporal discounting are most often assessed using monetary rewards. But, it has been demonstrated that temporal discounting can be applied to different commodities including food, alcohol, drug-related, sexual, or entertainment rewards as well (e.g., books and DVDs) (Chapman & Elstein, 1995; Charlton & Fantino, 2008; Estle, Green, Myerson, & Holt, 2007; Holt, Newquist, Smits, & Tiry, 2014; Tsukayama & Duckworth, 2010). Though studies have examined a variety of reward types, no studies have yet examined how using weight-loss as a reward is discounted. More than two-thirds of adults in the United States are overweight or obese (Ng et al., 2014), and over half of U.S. adults report a desire to lose their body weight (Gallup, 2013). In our society, therefore, weight-loss is generally viewed as rewarding, which opens the possibility of applying temporal discounting measures to body weight-loss. However, the majority of previous obesity studies have employed monetary intertemporal choice tasks, and none of them have explored temporal discounting of weight loss. Investigating temporal discounting with weight-loss rewards can be important to understand obesogenic mechanisms of decision-making. Particularly, considering the documented commodity-specific

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effects of temporal discounting, one's impulsivity for delayed monetary rewards might not apply to all aspects of obesity-related decision-making.

Successful weight-management programs typically require long-term persistence of lifestyle changes (Poirier & Despres, 2001). Weight loss is not immediate. We must be able to wait to lose weight. Thus, it is worthwhile to investigate how exactly subjective values or utilities of weight-loss rewards vary depending on outcome delays (e.g., 5 lbs weight-loss in 10 days vs. 100 days) and how they relate to obesity-related attitude measures. Being overweight or obese can cause psychosocial stress that has a tremendous negative impact on an individual (Puhl & Heuer, 2009). For example, overweight or obese persons are more likely to be perceived as less attractive, less trustworthy, and less healthy (Coetzee, Re, Perrett, Tiddeman, & Xiao, 2011; Hume & Montgomerie, 2001; Miller & Lundgren, 2010). A culture of negative social evaluations can be one of reasons why so many people, even with medically healthy body weight, desire to lose weight. Thus, we hypothesized that individual's positive or negative attitude toward obesity would affect subjective valuation or impulsivity about body immediate weight-loss.

In sum, weight loss rewards in temporal discounting choices have two very distinct psychological and physiological features, which may not be fully explained by other traditional monetary choice measures. First, the perceiving weight loss as a reward can be significantly influenced by individual's attitudes toward obesity or their body. Subjective psychological valuations of weight loss can be a critical determinant, which might be less relevant for monetary rewards. Second, the body weight loss requires "unavoidable" delays due to physiological restrictions of metabolic mechanisms, while people still may prefer to lose weight quickly. Thus, we believe further research is needed to better understand the relationship between temporal discounting of varying reward types and body mass.

The goals of the current study were to (1) examine temporal discounting based on weight loss rewards (through the Weight-loss Choice Questionnaire); (2) evaluate the relationship between monetary temporal discounting and weight-loss temporal discounting; (3) understand the relationship between weight-loss temporal discounting and other obesity-related psychological factors. Overall, this study furthers our understanding of obesity-related decision-making mechanisms by investigating temporal discounting of weight-loss rewards. Furthermore, characterizing individual differences in temporal discounting rates for weight-loss rewards may provide unique and valuable information for obesity interventions that cannot be achieved through monetary rewards.

Materials and methods

Participants

Sixty-eight healthy college students with a mean age of 23.0 ($SD = 5.9$ years; 14 males) were recruited through the Psych Pool online research participant recruitment system at the University of Missouri – Kansas City (UMKC). Participants received course credit for participating in the experiment. The study protocol was reviewed and approved by UMKC's Institutional Review Board. Prior to the experiment, participants provided written informed consent and completed demographics questionnaires.

Measures

Body weight and height were measured to calculate Body Mass Index (BMI) (kg/m^2) by using a scale and stadiometer (Detecto PD300DHR). After measuring their body weight and height, participants completed self-report questionnaires that included the Attitudes Toward Obese Persons (ATOP)/Beliefs About Obese Persons (BAOP) scales (Allison, Basile, & Yunker, 1991) and Anti-Fat Attitudes (AFA) scale (Crandall, 1994). The ATOP and BAOP scales measure explicit attitude and beliefs regarding obesity. Higher ATOP scores indicate positive attitudes toward obese persons, while higher BAOP scores indicate stronger beliefs that obesity is not under the obese person's control. The AFA questionnaire measures negative attitudes for overweight/obese people and includes "dislike", "fear of fat" and "willpower" subscales. Higher AFA scores indicate more negative attitudes.

Temporal discounting rates of monetary rewards

Individual's temporal (delay) discounting parameter (k) for monetary rewards were measured through the Monetary Choice Questionnaire (MCQ) (Kirby, Petry, & Bickel, 1999). The MCQ includes 27 hypothetical choices between a smaller, immediate monetary reward and a larger, delayed monetary reward (e.g., \$27 today vs. \$50 in 21 days). Responses are scored to calculate subjective discounting curves using hyperbolic decay function (see Fig. 1) (Mazur, 1987).

$$V_{\text{money}} = \frac{A}{1 + k_{\text{money}} \times D}$$

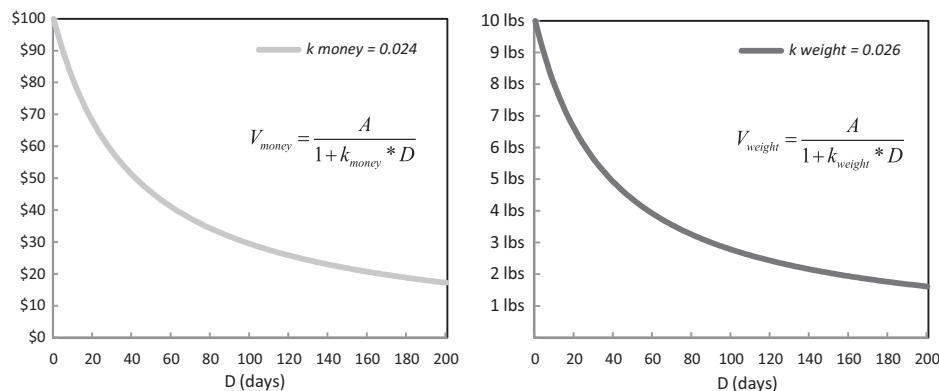


Fig. 1. Hyperbolic temporal discounting value (V) functions for monetary rewards (left) and weight-loss (right). For illustration purposes, the fixed amount of rewards ($A = \$100$ and 10 lbs), $k_{\text{money}} = .024$ and $k_{\text{weight}} = .026$ were used. See Methods for equations.

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