



Mediators of two selective prevention interventions targeting both obesity and eating disorders



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ABSTRACT

The present study tested hypothesized mechanisms underlying the effects of two selective prevention interventions targeting both obesity and eating disorders (*Healthy Weight* and the newly developed *Project Health*), relative to video control. Tests examined mediation for the significant weight gain prevention and eating disorder symptom prevention effects previously reported. College students ($N = 364$; 72% women) with weight concerns were randomized to condition and assessed for 2-years post-intervention. *Project Health* participants had significant improvements in 2 of the 7 proposed mediators relative to comparisons (i.e., cognitive dissonance, the unhealthy Western dietary pattern) but change in these variables did not mediate its effect on long-term BMI change. Two variables emerged as full mediators of the eating disorder prevention effects for both experimental interventions: body dissatisfaction and negative affect. Analyses failed to support the exploratory hypothesis that change in eating disorder symptoms mediated the effects of condition on BMI gain. This report is the among the first to examine mediation for programs aimed at preventing both weight gain and eating disorders, particularly in mixed-gender groups. Mediation analyses are essential in identifying the mechanism of intervention action, which can inform improvements to prevention programs.

1. Introduction

Obesity and eating disorders are prevalent chronic conditions associated with functional impairment, distress, physical and psychiatric morbidity, and mortality (Flegal, Carroll, Kit, & Ogden, 2012; Swanson, Crow, Le Grange, Swendsen, & Merikangas, 2011), prompting the need for prevention programs that reduce the onset of these two major public health problems. Although several prevention programs have sought to reduce future onset of both obesity and eating disorders, until recently only one has affected both outcomes. Compared to assessment controls, the 3-h *Healthy Weight* selective prevention program reduced weight gain, obesity onset, eating disorder symptoms, and eating disorder onset through 3-year follow-up (Stice, Marti, Spoor, Presnell, & Shaw, 2008; Stice, Shaw, Burton, & Wade, 2006). In *Healthy Weight* young women with body image concerns make small, lasting healthy changes to dietary intake and exercise that bring caloric intake and expenditure into balance, which should reduce weight gain, as well as risk for eating pathology. The participant-driven lifestyle change plan is intended to promote internalization of health goals and executive control over lifestyle choices. A refined version of *Healthy Weight* resulted in less weight gain through 6-month follow-up, greater weight gain prevention

through 1-year follow-up for initially overweight youth, greater eating disorder symptom reductions, and a 60% reduction in eating disorder onset over 2-year follow-up, versus educational brochure controls (Stice, Rohde, Shaw, & Marti, 2012; Stice, Rohde, Shaw, & Marti, 2013). An expanded 6-session version of *Healthy Weight* produced greater reductions in BMI and eating disorder symptoms than an active comparison control (cognitive reappraisal-based prevention; Stice et al., 2015).

We subsequently tested whether the efficacy of *Healthy Weight* could be enhanced by adding activities designed to induce cognitive dissonance about consuming unhealthy foods, a sedentary lifestyle, and excess body fat, based on a large body of research supporting the efficacy and effectiveness of a dissonance-based eating disorder prevention program (e.g., Stice et al., 2006, 2008). According to cognitive dissonance theory (Festinger, 1957), discussing the costs of engaging in unhealthy behaviors prompts people to align their attitudes with their publically displayed behavior. Our novel dissonance-enhanced eating disorder/obesity prevention intervention is a 6-h intervention (*Project Health*) that retained the participant-driven small, gradual healthy lifestyle modification plan, but added written and verbal exercises designed to create dissonance regarding lifestyle behaviors that contribute

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to excess weight gain, the costs of obesity, and the benefits of staying at a healthy weight.

The current randomized experimental therapeutics trial tested whether *Project Health* produced greater decreases in BMI and eating disorder symptoms, and lower future onset of overweight/obesity and eating disorders, than a 6-session version of the original *Healthy Weight* program (which lacks dissonance-induction activities) and an educational video control. College students ($N = 364$; 72% female) who were at risk for both outcomes due to weight concerns were randomized to condition and completed pretest, posttest, and 6, 12, and 24-month follow-up assessments (Stice, Rohde, Shaw, & Gau, 2018). *Project Health* participants showed significantly smaller increases in BMI at 2-year follow-up than both *Healthy Weight* participants and controls (both $d = -.18$), and significantly lower onset of overweight/obesity over 2-year follow-up than *Healthy Weight* participants and controls (13% vs. 21% and 22%, respectively). *Project Health* and *Healthy Weight* participants also showed significantly greater eating disorder symptom reductions ($d = -.15$ and $-.19$, respectively) and nonsignificantly lower rates of eating disorder onset (3% & 3% vs. 9% respectively; $p = .068$ & 0.064) than controls through 2-year follow-up. It is important to note that including men in this trial reduced the incidence of eating disorder onset, which might explain why these two effects did not reach significance.

These effects are encouraging, and it is important to further investigate the cognitive and/or behavioral processes that mediate these intervention effects, which is the goal of the present study. The aims were to test whether a set of hypothesized mediators accounted for (a) the significant weight gain prevention effects in *Project Health* relative to both the active comparison of *Healthy Weight* and education video controls, and (b) the significant eating disorder symptom prevention effects found in both *Project Health* and *Healthy Weight* relative to controls. An understanding of the mechanism(s) of intervention effects might guide improvements to existing prevention programs. For each of five potential mediators, we examined the degree of change for each proposed mediator during the intervention and whether that degree of change mediated the respective weight gain or eating disorder prevention effects.

The first potential mediator was cognitive dissonance about engaging in lifestyle behaviors that contribute to excess weight gain. Changes in attitudes about healthy behavior and related psychological constructs (e.g., self-efficacy for healthy behavior) have shown mediating effects for school-based obesity prevention programs (van Stralen et al., 2011), and prior eating disorder prevention research found that participants assigned to versions of an intervention that maximized versus minimized dissonance induction showed significantly greater reductions in eating disorder symptoms (Green, Scott, Diyankova, & Gasser, 2005; McMillan, Stice, & Rohde, 2011). Because of the dissonance-inducing activities unique to *Project Health*, including role-plays and written exercises regarding unhealthy foods and sedentary behavior, we anticipated that cognitive dissonance regarding engaging in behaviors that contribute to weight gain would mediate the observed weight gain prevention effects.

The second and third potential mediators were indices of dietary intake and physical activity. These two energy balance-related mechanisms are standard to almost all behaviorally based obesity prevention or treatment programs, and have been shown to mediate the effects of obesity treatments (Norman, Kolodziejczyk, Adams, Patrick, & Marshall, 2013; Teixeira et al., 2015) and weight gain prevention programs (Partridge, McGeechan, Bauman, Phongsavan, & Allman-Farinelli, 2016). These factors have been examined much less frequently in eating disorder prevention programs. Previous mediation research (Stice, Presnell, Gau, & Shaw, 2007) found that, relative to women in an expressive writing control condition, *Healthy Weight* participants showed significantly greater improvements in healthy eating and physical activity and that change in physical activity (but not dietary intake) correlated significantly with change in eating

disorder symptoms. Controlling for either dietary intake or physical activity, however, did not account for the effects of *Healthy Weight* on eating disorder symptom reduction.

The fourth and fifth potential mediators were body dissatisfaction and negative affect, both of which have been previously found to mediate interventions targeting obesity and eating disorders. Positive body image and self-worth, which are inversely correlated with negative affect, mediated the effects of successful overweight/obesity treatment interventions in the majority of existing studies, both in terms of achieving weight loss and increased physical activity (Teixeira et al., 2015). Regarding eating pathology, body dissatisfaction has predicted future increases in negative affect, which in turn predicted increased bulimic symptoms (Stice, 2011). Furthermore, *Healthy Weight* was found to produce significant improvements in body satisfaction and negative affect (Stice et al., 2008), and improved body satisfaction mediated the eating disorder effects of a previous dissonance-based eating disorder prevention program (Seidel, Presnell, & Rosenfield, 2009; Stice, Marti, Rohde, & Shaw, 2011).

In sum, the present study had two aims. First, we tested whether *Project Health* participants, compared to both participants in a credible alternative intervention (*Healthy Weight*) and an obesity education video control intervention, experienced greater improvements in dietary intake, physical activity, negative affect, body dissatisfaction, and greater change in cognitive dissonance regarding engaging in unhealthy lifestyle behaviors, and the degree to which these changes account for the reductions in BMI for *Project Health* participants versus participants in the other conditions. Second, we tested whether the combined sample of *Project Health* and *Healthy Weight* participants, relative to education controls, experienced greater changes in the same potential mediators and the degree to which these changes account for the reductions in eating disorder symptoms found in *Project Health* and *Healthy Weight* versus video controls. These analyses aim to elucidate the mechanisms of action that account for the successful effects of both of these interventions, and inform future iterations of these programs as well as other public health prevention programs.

2. Methods

2.1. Participants and procedure

Participants ($N = 364$) were 261 young women and 103 young men (M age = 19.2, $SD = 1.2$); 72% were Caucasian, 15% Asian/Pacific Islander, 11% Hispanic/Latino, 3% Black/African American, 3% Alaskan native, and < 1% Hawaiian native. Students ages 17–23 with weight concerns from 3 universities were recruited August 2012 to March 2014. Informed written consent was obtained as was approval from Institutional Review Boards from the institute supporting this project and participating universities. Exclusion criteria included a current DSM-IV diagnosis of anorexia nervosa, bulimia nervosa, or binge eating disorder; an interviewer-assessed BMI < 18 or > 30; or current participation in another eating disorder or obesity prevention research study.

Eligible participants were randomly assigned to the *Healthy Weight* intervention ($n = 122$), *Project Health* intervention ($n = 119$), or an educational video control condition ($n = 123$) via a random number table. Participants provided interview and survey data at pretest, posttest (intervention termination), and at 6, 12, and 24-month follow-ups, collected by female assessors masked to condition. Participants were financially compensated for completing each assessment. Both interventions consisted of 6 weekly 1-hr group sessions with 6–10 participants and 2 group leaders. If a participant missed a session, a brief (10–15 min) individual session was conducted to review material when possible. Additional study details are provided in Stice et al. (2018).

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