Directionality in the Relationship of Self-regulation, Self-efficacy, and Mood Changes in Facilitating Improved Physical Activity and Nutrition Behaviors: Extending Behavioral Theory to Improve Weight-Loss Treatment Effects

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ABSTRACT

Objective: To improve understanding of directionality in the dynamic relationships among psychosocial predictors of behavioral changes associated with weight loss.

Methods: In women with obesity participating in a new behavioral weight-loss treatment that emphasizes physical activity (n = 53; body mass index = 34.7 ± 3.3 kg/m^2), mediation and moderated-mediation models were fit to assess directionality in the self-efficacy–self-regulation change relationship and additional effects of mood change and its basis on fruit/vegetable intake and physical activity behaviors through month 6 and from months 6 to 24.

Results: Self-regulation was a stronger predictor of change in self-efficacy than vice versa. Mood change did not moderate the relationships significantly between changes in self-efficacy and/or self-regulation, and weight loss behavior. Emotional eating significantly changed mediated relationships between changes in mood and fruit/vegetable intake through month 6 (95% confidence interval, −0.05 to 0.00).

Conclusions and Implications: Findings clarified relationships of self-efficacy, self-regulation, and mood in the prediction of weight loss behaviors, and informed behavioral treatments for improved outcomes.

Key Words: self-efficacy, self-regulation, nutrition, physical activity, overweight, weight loss treatment, emotional eating (*J Nutr Educ Behav*. 2017;49:505-512.)

Accepted March 5, 2017.

INTRODUCTION

In the US, 69% of adults have overweight or obesity,[1] which increases health risks such as cardiovascular disease, type 2 diabetes, and hypertension.[2] Reductions in body weight of even 3% to 5% can reduce those health risks.[2] Behavioral (nonpharmaceutical/nonsurgical) weight loss treatments were overwhelmingly ineffective beyond the short term of 6–9 months.[3,4] Although physical activity is the best predictor of maintained weight loss,[5] adherence is poor without the use of a validated cognitive behavioral intervention.[6] This was evidenced by population-based, accelerometer-measured findings indicating that <4% of US adults reached even the minimum physical activity recommendation.[7] A 2014 National Institutes of Health working group on the problem of maintaining weight loss indicated that solutions still appeared elusive, but studies should be designed to identify and address malleable psychological correlates.[8]

Baranowski et al[9] and Baranowski[10] suggested that the lack of progress might be the result of treatments not adequately incorporating accepted behavior change theory. For example, Social Cognitive Theory posited individuals' potential for personal control over the environment and behaviors through cognitive factors such as self-efficacy, goals/motivations, self-regulation, and affect/emotion,[11,12] which suggested that treatments address those constructs. In 2000, tenets of Social Cognitive Theory were extended to a hypothetical model of long-term success with weight control suggesting that adherence to physical activity and improved eating behaviors emanate from changes in mood, feelings of well-being, body image, self-efficacy, self-esteem, and coping abilities.[13] Shortly after, studies of

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Conflict of Interest Disclosure: The authors' conflict of interest disclosures can be found online with this article on www.jneb.org.

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http://dx.doi.org/10.1016/j.jneb.2017.03.004

mostly women with different degrees of obesity sought to clarify psychosocial predictors of weight loss behaviors so that treatments could be informed accordingly. Based on lines of research detailed elsewhere,[14] both exploratory[15] and confirmatory[16] studies indicated that changes in self-efficacy, self-regulation, and mood (ie, 3-factor model[16]) explained large portions of the variance in both nutrition and physical activity behavior change. They also appeared to be appropriate targets for intervention design.

Although interrelations of such variables in weight loss intervention were given some attention, much remains unclear. For example, to improve behavioral weight loss treatments built on this 3-factor model,[16] and Social Cognitive Theory more generally, evaluation of directionality in the self-efficacy–self-regulation relationship is required. Also, a more complete understanding of the role of mood change in that relationship is needed, as well as how associated behavioral effects might also be explained through its association with emotional eating. Mood change, which is shown to be related to adherence to even moderate amounts of exercise,[14] was suggested to be a key component for sustained behavioral changes in ways that are not yet well understood.[13]

Therefore, this study aimed to extend available research on psychosocial correlates of weight loss behavior changes and their interrelationships within the context of a new behavioral weight loss treatment emphasizing exercise. It assessed and contrasted the explanatory power of various multivariate models in an effort to inform interventions and increase effects on weight management behaviors in women with obesity. Hypotheses were as follows: (1) changes in self-regulation emanating from self-efficacy changes would significantly mediate the relationship between self-efficacy and the weight loss behaviors tested (ie, physical activity and nutrition); (2) changes in self-efficacy emanating from self-regulation changes would significantly mediate the relationship between self-regulation and weight loss behaviors; (3) changes in self-regulation would be the stronger predictor of self-efficacy changes than vice versa; (4) change in mood would significantly moderate relationships between these predictors and weight loss behaviors; and (5) the relationship between mood change and change in nutrition would be significantly mediated by a change in emotional eating.

METHODS

Participants

Women aged 21–65 years, with a body mass index of ≥30 <40 kg/m^2 (grades 1 and 2 obesity), and reporting <20 min/wk average physical activity, volunteered for a behavioral weight loss study.[17] Reasons for exclusion included pregnancy, a psychological disorder, and current participation in weight loss treatment. The researchers obtained appropriate informed written consent from all participants and received approval from the institutional review board of Kennesaw State University. All procedures were performed in accordance with the Helsinki Declaration and its later amendments.

Based on the planned regression analyses with 3 predictors, for the effect size of $f^2 = 0.25$ (estimated from pilot research[14]), 42 participants were required for a statistical power level of 0.80 ($\alpha = .05$). With the exception of the extraction of 2 participants who did not complete psychological measures, all treatment group participants previously reported upon in the original investigation[17] were included in this supplementary study (n = 53; mean age, 47.8 ± 8.2 years; body mass index = 34.7 ± 3.3 kg/m^2; 75% white, 19% black, and 6% other; mostly middle income). Mean weight change was considered to be successful at –6.1% of baseline weight during baseline through month 6, with 0.8% regain through month 24.

Measures

Abbreviated versions of scales were used where reliability and validity would not be adversely affected. Internal consistency (Cronbach α) and test-retest reliability were considered adequate when their values were ≥.70. Concurrent and predictive validity was considered to have been demonstrated when an association with the measure of reference was statistically significant.

Internal consistencies and test-retest reliabilities (2- to 4-week intervals) of psychosocial measures were reported upon in previous research[14,18-22] and the primary study incorporating these data.[17] All were ≥0.70. Validity and reliability data of the behavioral measures are provided separately.

Daily combined intake of fruits and vegetables, which was suggested to indicate the quality of the diet as a whole,[23,24] was measured via single items that corresponded to serving sizes indicated in both the written material and websites of the US Department of Agriculture's Food Plate, and its earlier Food Guide Pyramid (eg, 1 small pear, 118 mL fruit juice, 118 mL broccoli or carrots).[25] The correspondence of the score of the brief recall of fruits and vegetables with more comprehensive, validated food frequency questionnaire results was strong ($\beta = .70–.80$; $P < .001$).[26,27] This provided evidence of concurrent validity. Predictive validity was indicated through the current measure's significant (inverse) relationship with weight loss in mostly middle-aged adults ($\beta = –.45$; $P < .001$).[14]

The researchers measured physical activity using the Godin–Shephard Leisure-Time Physical Activity Questionnaire,[28,29] which assessed recalled weekly physical activity outputs through metabolic equivalents (METs). For example, ≥15-minute bouts of physical activities such as easy walking, fast walking, and running were self-reported as 3, 5, and 9 METs, respectively. Frequencies of activities were multiplied by their corresponding MET value and then summed. The concurrent and predictive validity of the Godin–Shephard Leisure-Time Physical Activity Questionnaire was indicated through significant correspondence with accelerometer ($\beta = .45$; $P < .001$) and treadmill test ($\beta = .57$; $P < .001$) results.[29,30] Test-retest reliability over 2 weeks was 0.74.[29]

Self-efficacy for controlled eating was measured by the Weight Efficacy Lifestyle Questionnaire.[18] It had 20 items that addressed 5 circumstances (ie, negative emotions, social pressure, high food availability, physical discomfort, and positive activities such as viewing television) that challenged the perception of control over appropriate eating. Examples were: I can resist eating when I am depressed (or feeling down), and I can resist eating even when I think others will be upset if I do not eat.