



# Indirect effects of exercise on emotional eating through psychological predictors of weight loss in women



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## ABSTRACT

An improved understanding of how weight-loss interventions might be tailored to improve emotional eating is required. This study aimed to assess mediation of the relationship between increased exercise and decreased emotional eating so that behavioral treatments might be optimized. After randomization, women with obesity (N = 108; mean age = 48 years) were assigned to either a previously tested treatment of manual-based self-help for nutrition and exercise plus brief phone follow-ups, or a new protocol of cognitive-behavioral methods of exercise support intended to carry-over psychological improvements to better controlled eating and weight loss. A community-based field setting was incorporated. Validated self-report measures were administered over 6 months. Significant overall improvements in exercise outputs, emotional eating, mood, and self-regulation and self-efficacy for controlled eating were found. The newly developed treatment protocol demonstrated significantly greater improvements in exercise outputs and self-regulation. In a multiple mediation analysis, changes in self-regulation, self-efficacy, and mood significantly mediated the relationship between changes in exercise and emotional eating. Changes in self-efficacy and mood were significant independent mediators. Within follow-up analyses, the substitution of emotional eating subscales that addressed specific moods, and a subscale of self-efficacy for controlled eating that addressed that factor specifically in the presence of negative emotions, yielded results generally consistent with those of the multiple mediation analysis. Results suggested a psychological pathway of exercise's association with emotional eating changes in women with obesity. Guided by the present findings, tailoring exercise support and leveraging it to induce specific psychological improvements might reduce emotional eating and improve weight-management outcomes.

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## 1. Introduction

To develop more effective strategies for behavioral weight-management treatments, an improved understanding of psychological and behavioral determinants is needed. One area requiring further exploration is emotional eating, a form of disordered eating where there is “an increase in food intake in response to negative emotions” (Spoor, Bekker, Van Strien, & van Heck, 2007, p. 368). Emotional eating is common among women, and may serve as a barrier to weight loss and reductions in obesity-associated health risks such as hypertension, heart disease, diabetes, and some forms

of cancer (McElroy et al., 2004). Triggers for emotional eating include negative affect, life stressors, and unfavorable feelings related to one's weight status (Andrews, Lowe, & Clair, 2011). Negative emotions including anger, guilt, disappointment, and feeling hurt increased obese individuals' desire to overeat in one study (Zeeck, Stelzer, Linster, Joos, & Hartmann, 2011). In another study, anxiety, but not anger, was identified as a risk factor for emotional eating among individuals with obesity (Schneider, Appelhans, Whited, Oleski, & Pajoto, 2010). Obese adults with depressive symptoms and overall negative mood report greater emotional eating than those without symptoms (Geliebter & Aversa, 2003; Goldschmidt et al., 2014).

Approaches for addressing emotional eating have often been atheoretical, minimally successful, and difficult and expensive to administer to those in-need in a large scale manner. Methods, which are typically psychotherapist-driven, include: (a)

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recollection of previous traumatic events that might prompt over-eating as a defense mechanism (Felitti, Jakstis, Pepper, & Ray, 2010), (b) acceptance-based therapy where internal talk is used to acknowledge eating-related struggles (Forman, Butryn, Hoffman, & Herbert, 2008), (c) client-centered empathetic talk therapy (McElroy et al., 2004), and (d) the use of mindfulness approaches as a coping strategy for triggers to emotional eating (Kearney et al., 2012). However, in testing effects of group support, Mata and colleagues (Mata et al., 2009) identified “spill over” (their term) effects from increased exercise to reductions in emotional eating in overweight and obese women.

Completing even moderate amounts of regular exercise can positively influence mood, self-efficacy (i.e., feelings of ability), and use of self-regulatory skills (e.g., cognitive restructuring; stimulus control) – 3 theory-based factors shown to be key predictors of controlled eating and weight-loss success (Annesi, 2012; Annesi & Johnson, 2015). Exercise, especially initiation of a program of exercise after previously being sedentary, could influence emotional eating through its ability to foster improved self-regulation, by way of building feelings of ability and motivation to persist through perceived challenges (e.g., negative emotional states) (Andrade et al., 2010; Mata et al., 2009). Improved self-efficacy and self-regulatory skills developed through maintaining exercise and generalized into dietary improvements may be a consequence of a sense of controlling one's health (Baker et al., 2000), and might enhance individuals' abilities to sustain weight-loss. Although it remains unclear whether exercise-induced mood change has primarily a biochemical or psychological basis (Landers et al., 2001), it is also likely to mitigate emotional eating (Annesi & Vaughn, 2011).

Reduced caloric intake is crucial for weight loss, however exercise may be the most important predictor of long-term success with managing weight (Fogelholm & Kukkonen-Harjula, 2000; Svetkey et al., 2008). A proposed link between increased exercise, improved psychological factors, and healthier eating behaviors (Annesi, 2012; Annesi & Mareno, 2014; Biddle & Mutrie, 2008; Mata et al., 2009) was supported in women with severe obesity who, as a group, completed an average of only 2–3 bouts of moderate exercise per week, reduced their negative moods, increased their self-efficacy and ability to self-regulate eating, and had a clinically important reduction in weight over 6 months (Annesi, 2012; Annesi & Vaughn, 2011). It was hypothesized that exercise was related to weight loss more through its association with psychological predictors of controlled eating than through associated energy expenditures (Annesi, 2012). Psychological improvements' association with even moderate increases in exercise might be particularly important for women with obesity, who typically experience difficulty in adhering to demanding exercise regimens (Trost, Owen, Bauman, Sallis, & Brown, 2002). Because only 3% of U.S. women complete the minimum recommended amount of physical activity of 5 moderate sessions weekly (Troiano et al., 2008), treatments that avoid over-taxing physical tolerance and/or volition, while addressing barriers to exercise maintenance (e.g., slow progress, competing time demands) are important (Annesi, 2012). Presently, the inclusion of exercise is addressed differently across available weight-loss treatments (Mann et al., 2007). It ranges from passive suggestions to “try to be more physically active” to stressing intensive calorie-burning workouts; to strong, evidence-based exercise adherence methods paired with complementary cognitive-behavioral approaches that target eating behaviors.

Although factors such as increased self-regulation and self-efficacy, and improved mood have been explored in relation to increasing exercise and improving dietary behaviors (Andrade et al., 2010; Annesi, 2012; Goldschmidt et al., 2014), few studies have examined the *indirect* effects of increased exercise on

reductions in emotional eating through psychological pathways. No studies have contrasted treatment methods for their relative effectiveness at improving emotional eating through exercise-induced improvements in psychological variables. It is important for treatments to be evaluated based on their ability to effectively address salient factors in an efficient and effective manner; preferably with the possibility of large scale application (Baranowski, Lin, Wetter, Resnicow, & Hearn, 1997).

Thus, to address gaps in research related to both the theory and treatment of emotional eating through the use of exercise, the present investigation was initiated. If psychological mediators of a relationship between increased exercise and reduced emotional eating are found, exercise support methods might be specifically tailored to maximize improvements in emotional eating. The present 6-month study was designed to assess those possible relationships in women with obesity, while contrasting the outcomes from two cognitive-behaviorally based weight-loss treatments for reducing emotional eating. One treatment incorporated a written self-help manual supplemented by phone contacts (Comparison group). The other emphasized self-regulatory skills transferred from the context of exercise to one of improved eating via in-person meetings (Experimental group). The following hypotheses are given:

### 1.1. Hypothesis 1

The cognitive-behavioral treatment protocols of both the Comparison and Experimental groups will be associated with significant increases in exercise, and significant improvements in measures of emotional eating, mood, and eating-related self-regulation and self-efficacy.

### 1.2. Hypothesis 2

Because exercise was emphasized to maximize improvements in psychological predictors of healthy eating, improvements in mood, and eating-related self-regulation and self-efficacy, will be significantly greater in the Experimental treatment group.

### 1.3. Hypothesis 3

Increase in exercise output will be significantly related to reduction in the measure of emotional eating; and changes in self-regulation, self-efficacy, and mood will significantly mediate this relationship. Improvements in components of emotional eating will significantly relate to changes in similar components of the proposed mediators in a reciprocal, mutually reinforcing manner (e.g., reduction in depression will significantly relate to a reduction in the measure of emotional eating with depression, and vice versa).

Directionality of relationships between behavioral and psychological variables are often difficult to confidently assess. Therefore, the directionality within the proposed mediation analyses were based on a priori theory (Baker et al., 2000; Baranowski et al., 1997), related research (Annesi & Johnson, 2015; Annesi & Vaughn, 2011), previous direct analyses (Annesi & Mareno, 2014), and preliminary bivariate evaluation of temporality within the present data.

## 2. Material and methods

### 2.1. Participants

Participants were solicited through local print and electronic media in a similar manner. Inclusion criteria were: (a) female of age  $\geq 21$  years, (b) BMI  $\geq 30 \leq 40$  kg/m<sup>2</sup>, (c) no regular exercise (self-

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