



# Acute effects of exercise on women with pre-existing body image concerns: A test of potential mediators<sup>☆</sup>



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## ABSTRACT

The primary purpose of this study was to propose and test a mediation model of changes in physical self-efficacy, physical self-perceptions, and affect as mediators by which a single bout of exercise improves state body image. A secondary purpose was to identify how long improvements in state body image are sustained post-exercise. Sixty university-aged women ( $19.57 \pm 1.37$  y) with pre-existing body image concerns, and who exercised regularly, were randomized to perform 30 min of moderate-to-vigorous intensity exercise or quiet reading. State body image, physical self-efficacy, physical self-perceptions and affect were assessed. Mediation analyses revealed self-perceptions of body fatness (95% CI [0.03, 0.44],  $\kappa^2 = 0.13$ ,  $ab_{ps} = 0.20$ ) and strength (95% CI [0.15, 0.60],  $\kappa^2 = 0.23$ ,  $ab_{ps} = 0.33$ ) mediated improvements in state body image which were sustained at least 20 min post-exercise. These results contribute to the development of a model explaining the effects of exercise on body image and practical recommendations for the use of exercise to improve body image.

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## 1. Introduction

Body image is defined as “the multifaceted psychological experience of embodiment, especially but not exclusively one’s physical appearance” (Cash, 2004). It is a multidimensional construct that reflects one’s thoughts, feelings, evaluations and perceptions of one’s own body. Although body image is commonly described as an enduring trait that is consistent across varying situations (i.e., trait body image; e.g., Cash, 1990), research suggests that body image can also be situation-dependent, and can be conceptualized and studied as a state variable (i.e., state body image; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002).

In today’s society, there is a large emphasis placed on outward physical appearance and altering it to meet the ideal criteria dictated by mass media (Croll, 2005). The annual revenue of the

American weight-loss industry alone, consisting of diet drugs, weight-loss surgeries and diet books, is estimated to be over \$60 billion (Marketdata Enterprises, 2011). As poor body image can have harmful implications for a woman’s psychological and physical health, such as increasing risk for low self-esteem (Furnham, Badmin, & Sneade, 2002), depression, (Jackson et al., 2014), and eating disorders (Polivy & Herman, 2002), it is an important issue to address.

Exercise has received attention as a viable option for improving women’s body image dissatisfaction. Three meta-analyses examining the effects of exercise interventions on trait body image (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007) reported the same overall finding: exercise has positive, statistically significant effects on trait body image. With regard to state body image, for women who exercise regularly, a single bout of exercise for as little as 30 min can improve state body image (for a review, see Martin Ginis & Bassett, 2012). However, the mechanisms by which exercise improves body image are not fully understood. Unveiling potential mediators is imperative in order to develop maximally effective body image-enhancing exercise interventions, as mediators may be guides that point to possible mechanisms (Kazdin, 2007).

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### 1.1. Potential mediators by which exercise may improve body image

Research indicates that improvements in physical self-perceptions (an individual's judgments about his/her physical self) and self-efficacy, are key to inducing improvements in trait body image. Indeed, changes in body image are more strongly linked to perceived rather than actual changes in one's body. For instance, results of an exercise training study (Martin Ginis, Eng, Arbour, Hartman, & Phillips, 2005) revealed that the correlation between exercise-related changes in trait body image and perceived fatness was larger ( $r = 0.62$ ) than the correlation between changes in trait body image and actual body fatness ( $r = -0.23$ ). Likewise, an exercise training study (Martin Ginis, Strong, Arent, Bray, & Bassett-Gunter, 2014) involving university-aged women showed that trait body image changes were related to changes in perceptions of body fat, aerobic endurance, and aerobic self-efficacy, but not with actual physical changes (i.e., physical measurements). Furthermore, when exercise-related changes in both physical self-perceptions, self-efficacy and actual physical changes were tested together in a hierarchical regression model, physical self-perceptions accounted for the most explained variance in trait body image change over a 16-week exercise training program (Martin Ginis, McEwan, Josse, & Phillips, 2012). To our knowledge, no study has investigated whether changes in physical self-perceptions might account for the acute effects of exercise on state body image.

Of the few studies that have examined exercise and state body image, the results suggest that improvements in affect (e.g., increased energetic arousal and decreased tense arousal) may play a role in mediating the effects of exercise on state body image. LePage and Crowther (2010) assessed female exercisers' state body image and affect immediately after exercise and at random points throughout the day using ecological momentary assessment. Participants experienced less state body dissatisfaction and negative affect and more positive affect following exercise compared to the scores on measures of these constructs taken at random time points. These results supported earlier research suggesting that changes in state body image and mood may co-occur as the result of an exercise bout (Vocks, Hechler, Rohrig, & Legenbauer, 2009) and that changes in affect and state body image are at least weakly correlated (Niven, Rendell, & Chisholm, 2008). Thus, while preliminary, these findings provide some justification for considering affect as having a potential role in mediating the acute effects of exercise on body image.

### 1.2. Modeling the effects of exercise on body image

Because there are no accepted models to explain the effects of exercise on body image, researchers have applied the Exercise and Self-Esteem Model (EXSEM; Sonstroem & Morgan, 1989) to generate testable hypotheses (e.g., Martin Ginis et al., 2014). Fig. 1 depicts the EXSEM, which describes how exercise training can lead to improvements in global self-esteem. The constructs are organized hierarchically with body image representing one mechanism through which improvements in self-esteem may emerge (Sonstroem & Morgan, 1989).

According to the EXSEM, exercise directly influences change in physical measures (e.g., body composition), which then influences change in physical self-efficacy (i.e., one's confidence to perform specific physical tasks). Changes in physical self-efficacy will then impact changes in one's physical competence, operationalized as changes in physical self-perceptions (e.g., perceived stamina to run a race; Sonstroem, Speliotis, & Fava, 1992), which can then influence global self-esteem directly or indirectly through changes in physical acceptance (i.e., operationalized as one's satisfaction with

their body appearance; Sonstroem et al., 1992). Within the context of long-term exercise training studies, all of the constructs of the EXSEM have been shown to correlate with changes in the cognitive, affective and satisfaction dimensions of trait body image (Martin Ginis, Bassett-Gunter & Conlin, 2012). Presumably, the EXSEM can also be used to understand how a single, acute bout of exercise can impact state body image.

The right-hand panel of Fig. 1 shows our hypothesized model, based on the EXSEM, which depicts how the EXSEM constructs may operate in an acute exercise context. Global self-esteem has been removed from this model, given that change in body image (i.e., change in state body image) is our primary outcome of interest. (Physical measures have also been removed from this model as actual changes in one's strength, endurance, etc. are not relevant in the context of a single exercise bout). Further, although Sonstroem and Morgan (1989) postulated that self-efficacy change precedes change in physical self-perceptions, this causal, temporal relationship has in fact not been empirically tested. As such, in the hypothesized model, changes in self-efficacy and physical self-perceptions have been conceptualized as concurrent mediators. Change in affect has also been incorporated in the model given preliminary evidence suggesting it might play a role in exercise-related state body image change (LePage & Crowther, 2010; Niven et al., 2008; Vocks et al., 2009). Affect is depicted as a concurrent mediator because of its potential to both influence and be influenced by self-efficacy (Bandura, 1997) and the dearth of evidence regarding its temporal relationship with change in physical self-perceptions.

Using the hypothesized model as a guiding framework, the primary purpose of this experiment was to test the hypothesis that acute exercise-related changes in physical self-efficacy, physical self-perceptions, and affect are mediators by which a single bout of aerobic exercise improves state body image among women with pre-existing body image concerns. Investigating the factors that influence state body image in an exercise setting may provide a suitable foundation for developing models for explaining the effects of exercise on trait body image.

A secondary purpose was to identify how long exercise-related improvements in state body image are sustained. Drawing on evidence that acute exercise-induced changes in other psychological outcomes (e.g., affect) can persist for at least 20 min (Hall, Ekkkekakis, & Petruzzello, 2002; Van Landuyt, Ekkkekakis, Hall, & Petruzzello, 2000), it was hypothesized that state body image would be greater in the exercise condition in comparison to the control condition immediately after exercise (post-0) and throughout a 20-min recovery phase.

## 2. Method

### 2.1. Design

A two-condition, between-subjects, randomized controlled design was used. The two conditions were an experimental (exercise) condition and a control (quiet reading) condition. Repeated measures were taken at baseline, immediately post-manipulation and 10- and 20-min post-manipulation.

### 2.2. Participants

A power calculation was performed using the effect sizes of the alpha and beta pathways of the mediator under investigation (Frtiz & MacKinnon, 2007). The effect sizes from the affect literature were used for the power calculation, as there is more data available regarding the effect of exercise on affect than there is for the effects of exercise on physical self-perceptions or self-efficacy. An effect

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