Eating Behaviors 16 (2015) 9–12

Contents lists available at ScienceDirect

Eating Behaviors

Exercise dependence as a mediator of the exercise and eating disorders relationship: A pilot study

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ARTICLE INFO

Article history:
Received 26 June 2014
Received in revised form 18 September 2014
Accepted 24 October 2014
Available online 1 November 2014

Keywords:
Exercise dependence
Mediator
Eating disorders

ABSTRACT

Objective: Excessive exercise is a common feature of eating disorders (ED) and is associated with earlier ED onset, more ED symptoms, and higher persistence of ED behavior. Research indicates that exercise amount alone is not associated with ED. The purpose of this study was to investigate pathological attitudes and behaviors related to exercise (e.g., exercise dependence) as a mediator of the exercise and ED relationship.
Method: Participants were 43 women with an ED who completed measures of ED symptoms, exercise behavior, and exercise dependence. Analyses were conducted using the indirect bootstrapping method for examining mediation.
Results: Exercise dependence mediated the relationship between exercise and ED. This mediation model accounted for 14.34% of the variance in the relationship.
Discussion: Our results extend the literature by offering preliminary evidence of a psychological variable that may be a candidate for future interventions on the exercise and ED relationship. Implications and suggestions for future research are discussed.

1. Introduction

Excessive exercise is a common feature of all eating disorder (ED) variants, with prevalence rates ranging from 21% to 55% (Shroff et al., 2006). Exercise is associated with earlier ED onset, more ED symptoms, and higher persistence of ED behavior (Shroff et al., 2006). However, these detrimental associations are observed despite the amount of exercise engaged in by ED individuals often failing to either meet or exceed recommended physical activity guidelines (Garber et al., 2011; Peñas~Lledó, Leal, & Waller, 2002). Therefore, a need exists to identify psychological variables that may explain how exercise contributes to ED development, maintenance, and relapse (Cook & Hausenblas, 2014).

Exercise dependence is a term used to quantify and describe pathological behaviors and attitudes related to exercise (Hausenblas & Symons Downs, 2002) and refers to a phenomenon that has also been described as addictive, compulsive, driven, and/or obligatory exercise (Cook, Hausenblas, & Freimuth, 2014). Recently, exercise dependence has been identified as an important variable in the exercise and ED relationship (Bratland-Sanda et al., 2011). Specifically, obligatory attitudes and behaviors (i.e., exercise dependence symptoms), not time (i.e., amount) spent exercising, are positive predictors of negative eating attitudes, behaviors, and ED symptoms (Adkins & Keel, 2005). Furthermore, exercise dependence, not exercise behavior, has been shown to mediate the relationship between exercise and ED (Cook & Hausenblas, 2008; Cook, Hausenblas, Tuccitto, & Giacobbi, 2011). Thus, psychological factors such as exercise dependence but not exercise amount may explain why the exercise and eating disorder relationship exists. Understanding why this relationship exists may help identify those most at-risk for ED, how exercise exacerbates ED outcomes, and have implications in the role of exercise in ED treatment.

Indentifying potential mediators of the exercise and ED relation is important. However, the mediation effect has only been demonstrated in samples of undergraduate students and using proxy measures of ED behavior (e.g., drive for thinness) as the outcome variable (Cook & Hausenblas, 2008; Cook et al., 2011). Thus, confirmation of exercise dependence's mediating effect is needed in samples of individuals with ED. Therefore, the purpose of our study was to examine the relationships among exercise behavior, exercise dependence, and ED symptoms in a sample of ED individuals. We hypothesized that exercise dependence would mediate the exercise and ED relationship (Cook & Hausenblas, 2008; Cook et al., 2011).

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http://dx.doi.org/10.1016/j.eatbeh.2014.10.012
1471-0153/

Table 1
Participant characteristics.

	Mean	Standard deviation
Age	19.95	2.15
Body mass index	21.61	3.37
	n	Percent
Year in school		
Freshman	4	9.30%
Sophomore	23	53.49%
Junior	9	20.93%
Seniors	5	11.63%
Graduate/professional	2	4.65%
Ethnicity		
African American	3	6.98%
Asian	6	13.95%
Caucasian	29	67.44%
Hispanic	4	9.30%
Other	1	2.32%
Eating disorder diagnosis		
Full threshold anorexia nervosa	5	11.63%
Full threshold bulimia nervosa	13	30.23%
Subthreshold anorexia nervosa	10	23.26%
Subthreshold bulimia nervosa	15	34.88%
Exercise dependence status		
At-risk	4	9.53%
Symptomatic	19	45.24%
Asymptomatic	19	45.24%

2. Materials and methods

2.0.0.1. Procedure. All study procedures were reviewed and approved by the University of Florida Institutional Review Board. Participants in this report were from a larger study (Cook & Hausenblas, 2011) examining the relationship between exercise, health, and psychological states. Participants were recruited from large lecture style classes from seven colleges and universities in the United States through announcements regarding a study. After completing the informed consent, the students were given a pen and paper survey to complete during class time. The survey took about 15 min to complete. A total of 387 women completed the survey for the original study; the current study includes 43 of those participants that had anorexia nervosa or bulimia nervosa according to DSM-IV criteria.

2.0.1. Participants

Participants were forty three female university students (M age = 19.95 [SD = 2.15], M body mass index [BMI] = 21.61 [SD = 3.37]) from seven colleges and universities in the United States. Participant characteristics are described in Table 1. With regard to year in school, most of the women were sophomores (53.49%), followed by juniors (20.93%), seniors (11.63%), freshmen (9.30%), and graduate/professional (4.65%) year in school. Participants were mostly Caucasian (67.44%), followed by Asian (13.95%), Hispanic (9.30%), African-American (6.98%), and other (2.32%). ED status assessed by the Eating Disorder Diagnostic Scale (Stice, Telch, & Rizvi, 2000) revealed rates of full threshold anorexia (11.63%), full threshold bulimia (30.23%), subthreshold anorexia (23.26%), and subthreshold bulimia (34.88%). Exercise dependence status assessed by the Exercise Dependence Scale (Hausenblas & Symons Downs, 2002) revealed rates of at-risk (9.53%), symptomatic (45.24%), and asymptomatic of exercise dependence (45.24%).

2.0.2. Measures

2.0.2.1. Demographic Questionnaire. The Demographic Questionnaire assessed the participant's year in school, age, weight, height, and ethnicity.

2.0.2.2. Exercise Dependence Scale (EDS). The EDS (Hausenblas & Symons Downs, 2002) is a 21-item measure assessing the physiological and psychological aspects of exercise dependence symptoms. Examples of items include: 'I am unable to reduce how intense I exercise'; 'I exercise to avoid feeling tense'; and 'I exercise despite persistent physical problems'. Responses to the items are on a 6-point Likert scale ranging from 1 (never) to 6 (always). A lower score reveals fewer exercise dependence symptoms. The psychometric properties of this scale are good (Symons Downs, Hausenblas, & Nigg, 2004). The EDS internal consistency reliability in this study was excellent ($\alpha = .97$).

2.0.2.3. Leisure-time Exercise Questionnaire (LTEQ). The LTEQ is a validated self-report of the frequency and duration that an individual engages in strenuous, moderate, and mild bouts of exercise behavior during a typical week (Godin & Shephard, 1985). Minutes engaged in mild exercise were not used in these analyses, but the category was included in the questionnaire to ensure that participants did not report mild exercise minutes in the moderate intensity category [14]. Our interest in only moderate and strenuous exercise is based on public health recommendations for exercise and health benefits (Garber et al., 2011).

2.0.2.4. Eating Disorder Diagnostic Scale (EDDS). The EDDS (Stice et al., 2000) was used to determine ED symptoms and diagnosis. The EDDS is a brief (i.e., 22 items) and psychometrically sound measure for assessing symptoms and diagnostic features of: (a) anorexia nervosa; (b) bulimia nervosa; and (c) binge eating disorder. EDDS item sum scores have been validated for use as a measure of ED symptoms. The EDDS internal consistency reliability in this study was adequate ($\alpha = .85$).

2.0.3. Statistical analysis

We followed Preacher and Hayes's (2004) procedures for examining mediation. Correlations were used to determine the potential mediation relationship of exercise dependence symptoms (EDS; $M = 48.60, SD = 23.46$) on the exercise behavior (LTEQ; $M = 33.79, SD = 27.30$) and ED symptoms (EDDS symptom scores; $M = 25.67$, $SD = 15.68$) relationship. Because all variables were significantly correlated (see Table 2), and exercise behavior and exercise dependence exhibit a temporal relationship wherein behavior precedes dependence (Davis et al., 1997) the indirect mediation model with bootstrapping was followed (Preacher & Hayes, 2004). Mediation analyses testing the *a* path [i.e. the effect of exercise behavior (independent variable) on EDS scores (mediator variable)]; *b* path [i.e. the direct effect of the mediator on the ED symptom scores (dependent variable)]; the *c′* path [i.e. the direct effect of the independent variable on the dependent variable]; and *c* path [i.e. the total effect of the independent variable on the dependent variable]; were conducted (see Fig. 1). Furthermore, an estimate of the indirect effect was tested using the standard error and 95% confidence intervals calculated from 1000 bootstrapped samples.

Table 2
Study variable correlations; Notes: M = mean, SD = standard deviation; * = $p < .01$.

$N = 43$	Exercise Dependence Scale	Leisure-Time Exercise Questionnaire	Eating Disorder Diagnostic Scale
Eating Disorder Diagnostic Scale ($M = 25.67, SD = 15.68$)	$r = .558$*	$r = .378$*	1
Leisure-Time Exercise Questionnaire ($M = 33.79, SD = 27.30$)	$r = .760$*	1	
Exercise Dependence Scale ($M = 48.60, SD = 23.46$)	1		