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

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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.

Keywords

Exercise dependence; Mediator; Eating disorders

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.,

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Contributors

All authors have materially participated in the research and/or the manuscript preparation. The first and second authors designed the study and collected data. The third and fourth authors conducted analyses and assisted with study design. The fifth author provided content expertise and assisted in the critical review of the manuscript during preparation.

Conflict of interest

The authors have no conflicts of interest to declare.

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).

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 (α = .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 (α = .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.

3. Results

Results indicated a significant effect for the *a* path ($\beta = .4107$, SE = .0296, $p = .01$), *b* path ($\beta = .3262$, SE = .0432, $p = .01$), the c' path ($\beta = -.0739$, SE = .0301, $p = .01$) and the *c* path ($\beta = .0600$, SE = .0262, $p = .02$). The bootstrapped indirect effect ($c' = .1339$, 95% CI = (.0903–.1835)) was significant, indicating that exercise dependence mediated the relationship between exercise and ED. This mediation model accounted for 14.34% of the variance in the relationship among exercise behavior and eating disorder symptoms.

4. Discussion

The purpose of our study was to examine the identified mediation relationship among exercise and ED symptoms (Cook & Hausenblas, 2008; Cook et al., 2011) in a sample of ED individuals. Consistent with our hypothesis, exercise dependence exhibited a mediation effect in the exercise and ED relationship. Our data suggest that intervening on psychological factors (e.g., exercise dependence) may be useful in treating excessively exercising ED patients.

Theoretically, mediators identify causal risk factors, particularly when mediation effects are found using longitudinal research designs. Therefore mediators are candidates for breaking a multi-chain link of causal factors in the development of pathology (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001). Both the ED and exercise dependence literatures have found that excessive exercise is associated with anxiety, perfectionism, and obsessions (Cook & Hausenblas, 2014; Shroff et al., 2006) and that these are risk factors for the development of ED (Stice, 2002). Our current pilot study has provided initial evidence for a mediation effect of exercise dependence in the exercise and ED symptoms relationship. Thus, if this effect is supported with longitudinal research, directing interventions toward a mediator that is associated with each of these risk factors (e.g., exercise dependence) may satisfy recommendations to examine parsimonious multivariate approaches that have the ability to

intervene on psychological as well as biological factors (Hausenblas, Cook, & Chittester, 2008).

Several limitations were present in our study. First, these data were cross-sectional and therefore prohibit causal inference. Second, this was a pilot study using data collected from a larger study. Accordingly, our sample was limited in the number of ED individuals that were recruited. Although we assessed ED with a validated measure of ED diagnosis (i.e., the EDDS), using data from a preexisting study precluded clinical assessments for ED diagnosis. Additionally, the self-report assessment of exercise behavior precluded the use of objective physical activity monitors to examine the effect of exercise intensity level of all variables. Finally, the small number of ED individuals in our sample prevented examining mediation in separate samples of individuals with anorexia and bulimia. Thus, future research is encouraged to longitudinally examine the mediating role of exercise dependence in clinical samples of all ED variants. Future research is also encouraged to examine gender, ethnicity, and exercise intensity and mode (e.g., aerobic vs anaerobic) as potential moderators.

5. Conclusions

The relationship between exercise and ED is understudied despite evidence that exercise is associated with several detrimental clinical outcomes (Bratland-Sanda et al., 2011; Shroff et al., 2006). Therefore, identifying mediators of this relationship may help direct intervention efforts (Kraemer et al., 2001). Our results extend the literature by offering preliminary evidence of a possible psychological variable that may be such a candidate for future interventions (Hausenblas et al., 2008). Moreover, this pilot study suggests that continued examination of exercise dependence's role in ED development, maintenance, and relapse is warranted.

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References

Adkins CE, & Keel PK (2005). Does "excessive" or "compulsive" best describe exercise as a symptom of bulimia nervosa? International Journal of Eating Disorders, 38, 24–29.

Bratland-Sanda S, Martinsen EW, Rosenvinge JH, Rø Ø, Hoffart A, & Sundgot-Borgen J (2011). Exercise dependence score in patients with longstanding eating disorders and controls: The importance of affect regulation and physical activity intensity. European Eating Disorders Review, 19, 249–255. [PubMed: 21584917]

Cook BJ, & Hausenblas HA (2008). The role of exercise dependence for the relationship between exercise behavior and eating pathology: Mediator or moderator? Journal of Health Psychology, 13, 495–502. [PubMed: 18420757]

Cook BJ, & Hausenblas HA (2011). Eating disorder specific health-related quality of life and exercise in college females. Quality of Life Research, 20, 1385–1390. [PubMed: 21384263]

Cook B, & Hausenblas H (2014). The impact of exercise dependence, eating disorders and body dysmorphia in exercisers. In Chow A, & Edmunds S (Eds.), Physical exercise and mental health: Interconnections, theory and application (pp. 255–280). Champaign, IL: Human Kinetics.

Cook B, Hausenblas H, & Freimuth M (2014). Exercise addiction and compulsive exercising: Relationship to eating disorders, substance use disorders and addictions. In Brewerton T, & Dennis Baker A (Eds.), Eating disorders, addiction and substance use disorders: Research, clinical and treatment perspectives (pp. 127–144). New York, NY: Springer.

Cook BJ, Hausenblas HA, Tuccitto D, & Giacobbi P (2011). Eating disorders and exercise: A structural equation modeling analysis of a conceptual model. European Eating Disorders Review, 19, 216–225. [PubMed: 21584914]

Davis C, Katzman D, Kaptein S, Kirsh C, Brewer H, Kalmbach K, et al. (1997). The prevalence of high-level exercise in the eating disorders: Etiological implications. Comprehensive Psychiatry, 38, 321–326. [PubMed: 9406737]

Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee I, et al. (2011). Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: Guidelines for prescribing exercise. Medicine & Science in Sports & Exercise, 43(7), 1334–1359. [PubMed: 21694556]

Godin G, & Shephard RJ (1985). A simple method to assess exercise behavior in the community. Canadian Journal of Applied Sport Sciences, 10, 141–146.

Hausenblas HA, Cook BJ, & Chittester NI (2008). Can exercise treat eating disorders? Exercise and Sport Sciences Reviews, 36, 43–47. [PubMed: 18156953]

Hausenblas HA, & Symons Downs D (2002). How much is too much? The development and validation of the exercise dependence scale. Psychology & Health, 17, 387–404.

Kraemer HC, Stice E, Kazdin A, Offord D, & Kupfer D (2001). How do risk factors work together? Mediators, moderators, and independent, overlapping, and proxy risk factors. American Journal of Psychiatry, 158, 848–856.

Peñas~Lledó EF, Leal V, & Waller G (2002). Excessive exercise in anorexia nervosa and bulimia nervosa: Relation to eating characteristics and general psychopathology. International Journal of Eating Disorders, 31, 370–375.

Preacher KJ, & Hayes AF (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. Behavior Research Methods, Instruments, & Computers, 36, 717–731.

Shroff H, Reba L, Thornton LM, Tozzi F, Klump K, Berrettini WH, et al. (2006). Features associated with excessive exercise in women with eating disorders. International Journal of Eating Disorders, 39, 454–461.

Stice E (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. Psychological Bulletin, 128, 825–848. [PubMed: 12206196]

Stice E, Telch CF, & Rizvi SL (2000). Development and validation of the eating disorder diagnostic scale: A brief self-report measure of anorexia, bulimia, and binge-eating disorder. Psychological Assessment, 12, 123–131. [PubMed: 10887758]

Symons Downs D, Hausenblas H, & Nigg C (2004). Factorial validity and psychometric examination of the exercise dependence scale- revised. Measurement in Physical Education and Exercise Science, 84, 183–201.

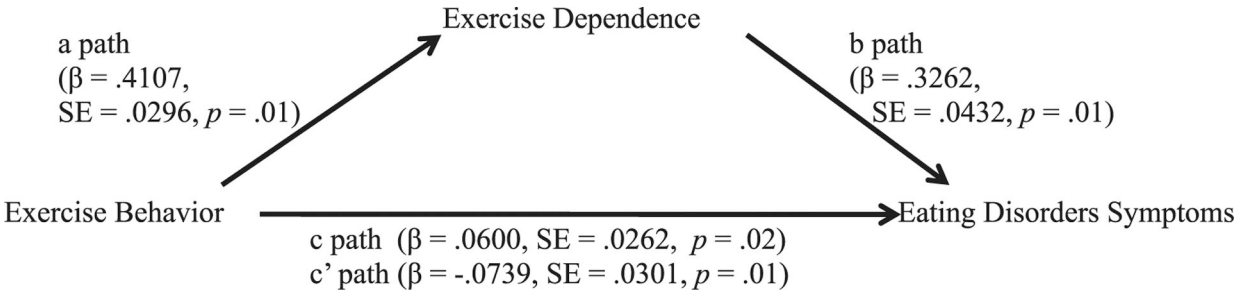

Fig. 1.
Mediation model with study variables.

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%

Table 2

Study variable correlations;

***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		

Notes: *M* = mean, *SD* = standard deviation;

* = *p* < .01.