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EXAMINING TYPES OF MOTIVATION FOR EXERCISE IN RELATION TO PATHOLOGICAL EXERCISE IN EATING DISORDERS

by

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Abstract

Exercise can serve adaptive and maladaptive functions among individuals with elevated eating disorder (ED) pathology; however, little is known about how best to distinguish healthy and problematic exercise within this population. The present study aimed to inform this distinction by examining associations between intrinsic and extrinsic motivations for exercise, problematic exercise, and ED pathology in a sample of undergraduate students (N=347, 70% female) with threshold or sub-threshold EDs. All participants completed the Eating Disorder Examination Questionnaire (EDE-Q), the Exercise Motivation Inventory-2 (EMI-2), the Compulsive Exercise Test (CET), and the Exercise Dependence Scale (EDS). Preliminary exploratory factor analysis of the EMI-2 revealed a ten-factor structure consisting of distinct extrinsic and intrinsic motives for exercise. Additionally, we conducted three separate multiple regression analyses to examine associations between exercise motives and compulsive exercise, exercise dependence, and ED pathology. In each model, extrinsic motives for exercise (e.g., social recognition) were associated with more severe exercise and ED pathology and intrinsic motives (e.g., prevention of health problems) were associated with less pathology. Interestingly, exercising for psychological benefits was associated with greater compulsive exercise and exercise dependence. Findings from this study suggest intrinsic and extrinsic motivations for exercise are differentially associated with exercise and eating pathology and can inform the distinction between problematic and healthy exercise among individuals with ED pathology.
Introduction

Eating disorders (EDs) are severe psychiatric diagnoses associated with numerous negative physical and psychological health consequences (Klump, Bulik, Kaye, Treasure, & Tyson, 2009). These disorders are relatively common with lifetime prevalence rates for DSM-5 diagnoses estimated at nearly three percent for young males and approximately 15 percent for young females (Allen, Byrne, Oddy, & Crosby, 2013). Although some efficacious treatments for EDs exist, many treatment-seeking individuals do not improve (e.g., Fairburn et al., 2009). There are many factors associated with ED severity, persistence, and treatment response, one of which is the presence of maladaptive exercise. Maladaptive exercise is commonly associated with ED pathology (Davis et al., 1997) and has been linked to greater psychological and physical impairment and reduced quality of life among individuals with EDs. Specifically, maladaptive exercise is associated with more severe and persistent ED and related (i.e., perfectionism, anxiety) pathologies (Shroff et al., 2006), longer duration of treatment (Solenberger, 2001), and shorter time to disorder relapse (Strober, Freeman, & Morrell, 1997). Despite the severe negative consequences of maladaptive exercise its strong association with ED pathology, little is known about how best to assess and treat maladaptive exercise in the context of EDs. Additionally, for some individuals with EDs, incorporating exercise into treatment may lead to improved treatment outcome (Hausenblas, Cook, & Chittester, 2008). Thus, improving our understanding of factors that differentiate adaptive and maladaptive exercise among those with elevated ED pathology will enable more accurate assessment of the nature of exercise and optimally effective treatment allocation.

Maladaptive Exercise and Eating Disorders
Maladaptive exercise among individuals with EDs can be conceptualized from behavioral and psychological perspectives. The behavioral perspective emphasizes the excessive frequency, duration, and intensity of exercise (Davis & Fox, 1993); however, this perspective is limited because many factors impact the appropriate level and intensity of exercise for each individual. Thus, excessive exercise behavior is difficult to operationalize resulting in inconsistent definitions across studies. The lack of consensus about what constitutes excessive exercise has contributed to inconsistent findings regarding excessive exercise and impairment among individuals with EDs. In contrast to the behavioral perspective, psychological conceptualizations of exercise focus on attitudes and beliefs about exercise rather than the quantity of exercise behaviors. From a psychological perspective, problematic exercise (PE) refers maladaptive exercise attitudes and resulting exercise behaviors that persist despite negative physical (e.g., injury), psychological (e.g., anxiety, guilt), and social (e.g., isolation) consequences resulting from exercise (Bamber et. al., 2003).

Recent research examining PE and ED pathology has shown that psychological components of PE are associated with more severe ED pathology and decreased quality of life (e.g., Bardone-Cone et al., 2016; Holland, Brown, & Keel, 2014; Taranis, Touyz & Meyer, 2011). In contrast, these studies have not found an association between the quantity and intensity of exercise behaviors and ED severity or impairment (e.g., Adkins & Keel, 2005; Mond, Hay, Rogers, & Owen, 2006). Therefore, the psychological qualities of PE among individuals with ED pathology determine whether exercise is adaptive or problematic, not the intensity and quantity of exercise behaviors. These psychological qualities can explain the development and maintenance of PE and within
the ED literature there are two primary multi-dimensional theories: compulsive exercise (CE) and exercise dependence.

**Compulsive exercise.** PE can be conceptualized as a compulsive behavior in association with EDs and is primarily maintained through avoidance of negative affective states (e.g., anxiety, guilt) associated with not exercising. A model of CE for individuals with EDs proposed by Meyer, Taranis, Goodwin, and Haycraft (2011) posits that the relationship between ED pathology and CE is reciprocal. In this model concerns about body shape and weight initially drive exercise behaviors and exercise behaviors lead to decreases in these concerns. Eventually, the negatively reinforcement associated with exercise behaviors leads to continued exercise behaviors as a means of regulating negative affect and preventing perceived negative effects of not exercising on body shape and weight (i.e., decreased attractiveness and weight gain). In addition to this core process, Meyer et al.’s (2011) model also includes secondary factors (i.e., perfectionism, rigidity, and psychological benefits of exercise) that contribute to the development and maintenance of CE.

Taranis et al. (2011) examined this model of CE in a sample of female exercisers and found support for a five-factor model in which exercise is maintained through rule-driven exercise behavior to avoid negative affect; exercising for shape and weight concerns; exercising for mood improvement; lack of exercise enjoyment; and rigid patterns of exercise behaviors. Further in support of Meyer et al.’s (2011) original model, recent work has shown that secondary factors (e.g., perfectionism, compulsiveness) are associated with increased CE (Egan et al., 2017; Noetel, Dawson, Hay & Touyz, 2016).
CE is strongly associated with ED pathology and related psychological impairment. In their original study, Taranis et al. (2011) determined that CE was strongly associated with ED pathology and that, of all the component of CE, weight control exercise was most highly associated with aspects of ED pathology. Since this original study, the association between ED pathology and CE has been replicated numerous times. For example, in a 2016 study of a large community sample of men and women, Cunningham, Pearman, and Brewerton found a strong association between CE and the severity of ED pathology. Other recent work has extended our understanding of CE among individuals with EDs by providing support for association between CE and other psychological problems including depression, obsessive-compulsiveness, anxiety, and low self-esteem (Noetel et al., 2016); however, CE is not the only form of PE associated with ED. Rather, as shown by Cunningham et al. (2016), there is also as association between ED pathology and another form of PE, exercise dependence.

**Exercise dependence.** PE can be conceptualized as an addictive behavior and this view is among the most supported and studied alternatives to CE. Exercise, like other addictions, serves two functions: to reduce negative affect and increase positive experiences (Goodman, 2008). Initially, exercise behaviors are maintained through positive reinforcement (e.g., enjoyment); however, over time, more exercise behaviors are necessary to attain the same benefits and exercise increasingly functions to prevent or alleviate negative states (e.g., withdrawal symptoms) associated with not exercising. At this point, an individual becomes dependent on exercise as a means of maintaining neutral levels of psychological and physical comfort. Although the negative affect regulation component of exercise dependence resembles CE, this view of PE is distinct in
its emphasis on the continuation of positive benefits of exercise (Cook et al., 2014). Exercise dependence, like substance dependence, is defined by: (a) tolerance to the benefits of exercise and the requirement for greater exercise intensity or duration to achieve the same benefits; (b) physical and psychological withdrawal symptoms associated with not exercising; (c) greater than intended frequency, intensity, or duration of exercise; (d) unsuccessful attempts to decrease the frequency, intensity, or duration; (e) increased time spent exercising; (f) reduction in social, recreational, or occupational activities because of exercise; and (g) continued exercise despite knowledge of physical and psychological problems that are caused or increased by exercise (Hausenblas & Downs, 2002).

Exercise dependence is associated with increased severity of ED pathology (e.g., Bratland-Sanda et al., 2010; Cunningham et al., 2016; Cook et al., 2015,). Additionally, recent work by Cook et al. (2014), found a significant interaction between ED pathology and exercise dependence on quality of life impairment such that, for those with more severe ED pathology, exercise dependence was associated with greater reductions in quality of life. Taken together these findings indicate that exercise dependence is associated with increased ED related impairment and negative consequences.

**Positive Benefits of Exercise**

Although PE is associated with many negative consequences, exercise can also serve adaptive purposes for individuals with EDs. Exercise has many physical and psychological benefits (United States Department of Health and Human Services, 2008) and many of these benefits are specifically relevant to EDs (e.g., improved cardiovascular health, increased bone density, decreased anxiety and depression, and improved self-
esteem and body image; Cook et al., 2014; Hausenblas & Fallon, 2006). In the absence of PE, exercise is associated with these benefits among individuals with EDs (Cook et al., 2011) and may function to decrease risk for EDs and improve treatment outcomes by impacting factors associated with the development and maintenance of eating disorders. Much existing research supports the utility of incorporating exercise into the treatment of depression and anxiety (e.g., Schuch et al., 2016) and exercise has recently been proposed as a promising treatment for EDs (Hausenblas et al., 2008).

**Exercise as a treatment for eating disorders.** Some recent research has examined the efficacy of exercise interventions for EDs. In a 2008 review of six exercise treatment studies for EDs, Hausenblas et al. concluded that, for those with EDs, exercise treatment resulted in improvements in body composition, self-esteem, quality of life, body satisfaction, mood, and ED pathology. Similarly, Cook et al. (2016) concluded that incorporating exercise into the treatment of EDs is associated with positive outcomes. Additionally, they developed clinical guidelines for incorporating exercise into the treatment of eating disorders that emphasized the importance of screening for exercise-related pathology, focusing on promoting the positive reinforcement from exercise, and debriefing following exercise sessions.

**Barriers to exercise in eating disorders treatment.** Despite recent support for the advantages of exercise in the treatment of EDs, exercise remains a controversial treatment for EDs and is infrequently utilized. Significant barriers to the implementation of exercise in ED treatment include clinicians’ misconceptions about exercise and EDs; concerns about the medical safety of exercise; and limited confidence in their abilities to assess and incorporate appropriate exercise into treatment plans (Hausenblas et al., 2008;
Noetel et al., 2016). These barriers highlight the need for improved understanding of exercise and EDs, and suggest that developing a more nuanced understanding of factors that distinguish PE from adaptive exercise behaviors among individuals with EDs might enable better differentiation. One way we can better understand exercise among individuals with EDs is by examining motivations for exercise.

**Self-Determination Theory**

Self-determination theory (SDT; Deci & Ryan, 2000) is a theory of motivation that emphasizes the distinction between qualitatively different motivational processes and their associations with differential psychological and behavioral outcomes. Within this framework broad forms of motivation are associated with the contents of specific motives.

**Types of motivation.** SDT distinguishes between three main forms of motivation: amotivation, extrinsic motivation, and intrinsic motivation. These forms of motivation exist on a spectrum ranging from amotivation (i.e., the absence of motivation) to intrinsic motivation (i.e., engaging in a behavior for the pure enjoyment of behavior without regard for external contingencies). Lying between these poles are various forms of extrinsic motivation. Extrinsic motivation for behavior is based on the attainment of external contingencies and is further divided into four sub-categories, each of which varies in extent to which external contingencies are important. These four sub-categories include: *external regulation* is behavior solely motivated by external contingencies (e.g., behaving due to pressure from others), *introjected regulation* is characterized by partially internalized external contingencies leading to behavior aimed at attaining self-imposed contingencies (e.g., behaving to avoid negative affect); *identified regulation* is when the
consequences of a behavior, but not the behavior itself, are valued (e.g., behaving because the outcome is personally meaningful) and integrated regulation is when the behavior aligns fully with an individual’s values but appreciation of the behavior itself is not completely motivating (e.g., behaving because the behavior itself is personally meaningful or enjoyable). This motivation spectrum reflects the extent to which the motivation is considered self-determined. Intrinsic motivation, integrated regulation, and identified regulation are commonly grouped together as autonomous motivation and are highly self-determined, whereas external regulation and introjected regulation are considered controlled motivation and are less self-determined forms of motivation. This distinction between autonomous and controlled motivations is meaningful because these types of motivation are differentially associated with positive and negative psychological outcomes (Vallerand, 1997). Specifically, autonomous motivations lead to better psychological outcomes, whereas controlled motivations lead to psychological distress and negative consequences.

**Types of Motivation and Eating Pathology.** Motivational processes may help explain the positive and negative outcomes associated with eating regulation and ED pathology. Specifically, controlled motivation for eating regulation may lead to rigid and distressing eating patterns that subsequently result in increased ED symptomology; unsuccessful attempts at weight control, and associated psychological distress (Verstuyf, Patrick, Vansteenkiste, & Teixeira, 2012). A study by Pelletier and Dion (2007) found that autonomous motivation for eating regulation (e.g., eating for nourishment and to promote positive health) was associated with healthier eating behaviors, lower levels of body dissatisfaction, and better psychological outcomes. In contrast, controlled
motivations for eating regulation (e.g., eating a certain way do to the requests of others or regulating eating patterns to lose weight) were associated with more bulimic symptoms, greater levels of body dissatisfaction, and greater psychological distress (depression, low self-esteem, low life satisfaction).

**Types of motivation and exercise behaviors.** Similarly, types of motivation have been applied to the study of exercise behaviors. Results from studies of participants without EDs show that different forms of motivation are associated with varying levels of exercise adherence and positive outcomes (see Teixeira et al., 2012 for a review). Specifically, across studies, autonomous motivations were associated with increased participation in adaptive exercise behaviors whereas controlled motivations were associated with cessation of exercise behaviors. Interestingly, a review of the literature indicated that type of motivation was associated with long-term adherence to exercise routines. Autonomous motivation for exercise was associated with long-term adherence to exercise routines whereas controlled motivation was associated with only short-term adherence and premature cessation of exercise routines.

Types of motivation have also been studied in association with PE. For example, in a study of endurance athletes, Hamer, Karageorghis, & Vlachopoulos (2002), found that controlled motivations for exercise were associated with exercise dependence while autonomous motivations were not associated with exercise dependence. They interpreted the association between controlled motivation and exercise dependence as a reflection of the importance of exercising to relieve negative affect in the conceptualization of exercise dependence. Exercising to reduce negative affect would be considered a controlled motivation, specifically introjected regulation, thus explaining the association between
controlled motivation and exercise dependence. Taken together, results from studies examining associations between motivational processes and eating and exercise behaviors have supported the important role of types of motivation in determining adaptive and maladaptive eating and exercise behavioral patterns; however, to date, no work has specifically examined the role of type of motivation (i.e., controlled vs. autonomous) for exercise in the context of EDs.

Specific Motives. Types of motivation underlie the contents of specific motives for behaviors such that different motives for behaving can be understood as reflecting various levels of self-determined motivations. Specific motives for behaviors include individuals’ articulated reasons for behaving (e.g., “because I want to lose weight”) and are more concrete and easily assessed components of SDT than motivational processes. Different motives can reflect different levels intrinsic and extrinsic motivation and are therefore associated with various levels of positive and negative outcomes including outcomes related to eating and exercise behaviors.

Specific motives for Eating Regulation and Eating Pathology. Research examining these motives in association with ED pathology has examined the role of specific motives that reflect controlled motivation (i.e., introjected regulation) and autonomous motivations (i.e., integrated motivation). Specifically, results from these studies have shown that appearance-focused (i.e., controlled) motives for eating regulation are associated with increased ED pathology whereas health-focused (i.e., autonomous) motives are associated with adaptive outcomes. For example, in a 2012 study, Verstuyf, Vansteenkiste, & Soenens found that appearance-focused motives for eating regulation were associated with increased bulimic symptoms whereas health-
focused motives were negatively associated with bulimic symptoms. These results suggest that more self-determined (i.e., autonomous) motives for eating regulation are associated with better outcomes (e.g., decreased ED symptoms).

**Specific motives and exercise behavior.** Within the exercise literature, findings regarding associations between specific exercise motives and adaptive exercise behaviors are mixed (see Teixeira et al., 2012 for review). To date, much of this work has focused on broad psychological motives (e.g., exercising for positive psychological benefits), body-related goals (e.g., exercising to improve appearance), interpersonal goals (e.g., exercising for social recognition), fitness motives (e.g., exercising to gain strength and endurance), and health motives (e.g., exercising to avoid negative health consequences) and is limited by inconsistent operationalization and measurement of each of these motives. For example, across studies, psychological motives for exercise have included exercising to avoid feelings of guilt (i.e., introjected regulation) and exercising for enjoyment (i.e., intrinsic motivation). Based on recent work, we would expect these motives to be associated with different levels of adaptive behavioral and psychological outcomes; therefore, it is not surprising that there are inconsistent results across studies. Thus, rather than examining the literature as a whole, examining studies with consistent operationalization of specific motives will enable the development of accurate conclusions.

Accordingly, some studies have examined specific motives grounded in SDT with consistent definitions of exercise motives. These studies have supported the differential outcomes associated with theoretically different motives for exercise. For example, Maltby and Day (2001) investigated associations between exercise motives and exercise
adherence over time. They found that long-term exercises reported higher levels of autonomous motivations for exercise (e.g., challenge, enjoyment), while controlled motivations (e.g., social recognition) were more common among short-term exercisers. They also examined relations between controlled and autonomous motives for exercise and psychological well-being. Specific motives reflecting autonomous motivations for exercise were associated with improved self-esteem while motives reflecting controlled motivation for exercise were associated with increased anxiety, depression, social dysfunction, and somatic symptoms. Thus, these findings provide support for the importance of level of self-determined motivation for exercise in determining psychological well-being.

Similarly, Ingledew and Markland (2007) examined the mediating role of type of motivation in the association between specific motives for exercise and leisure time exercise behavior. In a community sample with relatively low levels of physical activity, exercising for appearance and weight reasons was associated with less exercise behavior whereas health and fitness motives for exercise were associated with more adaptive exercise behavior. Additionally, appearance and weight-related motives for exercise were highly related to external regulation and introjected regulation, which were subsequently associated with less exercise behavior. This finding provided direct support for the theoretical conceptualization of appearance and weight-related motivation for exercise as reflections of controlled motivations. Also in support of the theory, identified regulation explained the association between health and fitness motives and adaptive exercise behaviors such that individuals with health and fitness motives for exercise engage in exercise behaviors because they believe that being healthy is important. Finally, social
engagement motives for exercise (e.g., exercising to spend time with friends) were associated with intrinsic motivation. Although social engagement motive for exercise was not associated with exercise behaviors in this sample, the finding that this motive reflected intrinsic motivation suggests that it may be associated with more adaptive exercise behaviors in larger sample with higher levels of physical activity. These two studies, in addition to others with consistent SDT conceptualizations of exercise motives, suggest that specific motives are important in determining adaptive and maladaptive exercise patterns.

**Exercise Motives and Eating Disorders.** Within the context of EDs, no existing research has examined SDT based motives for exercise. Instead, much of this work has focused on atheoretical broad domains of exercise motives in relation to ED pathology. This work has consistently supported the link between appearance, weight, and health-related motives for exercise and body image concerns and ED pathology. For example, Vartanian, Wharton, and Green (2012) found that appearance and weight related motives for exercising were associated with greater body dissatisfaction whereas exercising for health reasons was associated with better body image. Vinkers et al. extended these findings in a 2012 study that investigated the impact of appearance and health motives on the relationship between body image and eating pathology. They found that appearance-related motives for exercising partially explained for the relationship between body dissatisfaction and ED pathology. Interestingly, their results also indicated that health motives for exercise were not associated with eating pathology.

Other recent research has examined specific motives for exercise and EDs by comparing specific exercise motives between individuals with and without EDs.
Bardone-Cone et al. (2016) found that individuals with active EDs endorsed greater appearance and weight related reasons for exercise than those without active EDs. Furthermore, appearance and weight related motives for exercise are related to PE among individuals with EDs. Results from a 2015 study by Keyes et al. supported this association. They found that weight control and appearance-related reasons for exercise predicted PE.

To date, most of the work regarding specific motives for exercise and EDs has focused on weight and appearance related reasons for exercise; however, a few studies have examined social and mood related motives for exercise in relation to PE and ED pathology. For example, Bardone-Cone et al. (2016) found that those with active EDs reported exercising for stress and mood management more than healthy controls while there were no differences in fitness, health, and social motives differences between those with and without EDs. These results suggest that although appearance and weight-related motives for exercise differentiate those with EDs from those without, individuals with EDs also report alternative motives for exercise. Keyes et al. (2015) further extended our understanding of the association between alternative exercise motives and PE. They found that, among those with EDs, mood, health, and tone related motives for exercise were all associated with increased PE. These findings suggest that a wide range of motives for exercise play an important role in determining whether exercise behaviors are adaptive or problematic among individuals with EDs.

Overall, these findings align with theoretical conceptualizations of PE and support for the importance of exercising for weight, appearance, and affect related motives; however, recent work has not examined the impacts of some forms of autonomous
motivation for exercise (e.g., social affiliation, exercise enjoyment) on PE in those with EDs. Additionally, the current literature is limited in a number of ways including exclusive examination of samples of white females, loose definitions and measurement of PE, and over-reliance of a single measure of exercise motives (the Reasons for Exercise Inventory, REI; Silberstein et al., 1988) designed to broadly assess motives without an underlying theoretical conceptualization of motivation.

The exclusive examination of white female samples limits the generalizability of findings from recent work. EDs and PE also impact males and ethnic and racial minorities (Allen et al., 2013; Cunningham et al., 2016), thus it is important to extend research to include these populations. Additionally, some research suggests that the nature of PE may differ across populations (e.g., Cook, Hausenblas, & Rossi, 2013), further highlighting the importance of examining determinants of PE in diverse populations with elevated ED pathology. Variations in the definition and measurement of PE further limit interpretation of findings from recent research. This work has either not considered the association between exercise motives and PE or has loosely defined and measured a broad range of forms of PE. As previously described, there are numerous etiologies of PE with significant variation in underlying mechanisms, therefore, different forms of PE may be differentially related to exercise motives.

Finally, existing research has focused primarily on mood improvement, appearance improvement, and weight control motives for exercise. These motives have been consistently linked to increased ED pathology; however, little is known about the impact of other motives for exercise (e.g., enjoyment, competition, social affiliation) on PE and ED pathology. Examining these motives for exercise among individuals with ED
pathology will improve our understanding of factors that differentiate PE from adaptive exercise among those with elevated ED pathology.

**Current Study**

In summary, recent work has identified the importance of understanding the distinction between adaptive exercise behaviors and PE among individuals with EDs. Existing work has supported the importance of types of motivation and specific motives in determining adaptive and problematic eating and exercise behaviors. Additionally, some work has begun to examine the impact of specific motives for exercise on ED pathology and PE; however, this research is limited by small and homogenous samples, inadequate and atheoretical measurement of exercise motives, and an over-emphasis on appearance and weight related motives and has not considered the roles of alternative reasons for exercise.

The current study aimed to improve our understanding of the nature of PE within the context of EDs by examining the differential impacts of specific motives for exercise on PE and ED pathology. In order to accomplish this goal, the current study had three aims. The first aim of the study was to extend our understanding of the nature motives for exercise in individuals with ED pathology by examining the factor structure of a measure of exercise motivations based on SDT (the Exercise Motivation Inventory, EMI; Markland & Ingledew, 1997) in a sample of individuals with threshold and subthreshold EDs. This measure has been used to study exercise motivations in community samples and reflects the underlying motivational processes of SDT (Ingledew & Markland, 2007); however, its factor structure among individuals with EDs is unknown. Additionally, we investigated the nature of different motivations for exercise behaviors within a sample of
individuals with eating pathology by examining which motives were most highly endorsed within our ample. We predicted that individuals with ED pathology would endorse motives reflecting both controlled (e.g., appearance and weight-related) and autonomous (e.g., social connection, enjoyment) types of motivation for exercise.

Our second aim was to refine our understanding of the nature of the association between self-reported motives for exercise and ED pathology by examining the relative importance of each specific motives for exercise in predicting severity of ED pathology. We hypothesized that motives reflecting less self-determined (i.e., controlled) motivation would be associated with more severe ED pathology while more autonomous motivations would be associated with less severe ED pathology.

The third aim of this study was to inform our understanding of motivation for exercise among individuals with EDs by examining the relative importance of specific motives for exercise in predicting PE among individuals with EDs. Again we hypothesized that specific motives reflecting autonomous motivations (i.e., enjoyment, social affiliation, challenge, strength and endurance) would be negatively associated with pathological exercise and motives reflecting controlled motives for exercise (i.e., social recognition, appearance) to be associated with higher levels of pathological exercise.

**Method**

**Procedure**

Proposed methods were reviewed and approved by the Institutional Review Board at the State University of New York at Albany prior to beginning the present study. Participants were recruited through the university’s introductory psychology research pool as part of a larger study examining eating and exercise behaviors and all participants
received course credit in exchange for their participation. The present study included a subset of participants from this original study with threshold and sub-threshold EDs. ED diagnoses were determined based on DSM-5 (American Psychological Association, 2013) diagnostic criteria for Anorexia Nervosa (AN), Bulimia Nervosa (BN), Binge-Eating Disorder (BED), and Other Specified Feeding or Eating Disorders (OSFED) using an algorithm developed by Berg et al. (2012) for responses on the Eating Disorder Examination Questionnaire (EDE-Q).

Participants attended a single laboratory appointment. Upon arriving for their research appointment all participants were guided through informed consent for research participation by undergraduate research assistants. Notably, we avoided using terms such as ‘eating disorder’ and ‘pathological exercise’ to prevent possible response bias resulting from the negative connotations of these terms. Following informed consent, participants completed a series of questionnaires on an online survey platform. Questionnaires relevant to the current study are described below.

**Measures**

**Eating Disorder Examination Questionnaire (EDE-Q; Fairburn & Beglin, 1994).** The EDE-Q is among the most commonly used measures of ED pathology and contains 28-items designed to measure cognitive and behavioral components of EDs. Respondents indicated the frequency of ED related behaviors (e.g., “on how many of the past 28 days have you gone for long periods of time (8 hours or more) without eating at all in order to influence your shape or weight?”) and cognitions (“on how many of the past 28 days has thinking about food, eating or calories made it very difficult to concentrate on things are you interested in?”) using a 7-point likert scale ranging from 0
(no days) to 6 (everyday), Additionally, respondents indicated the extent to which they experienced ED related cognitions (e.g., “How much has your shape influences how you think of yourself as a person?”) over the previous 28 days using a 7-point likert scale ranging from 0 (not at all) to 6 (markedly). This scale has been examined in clinical and non-clinical ED samples and has demonstrated high internal consistency, test-retest reliability, and correlations with other measures of ED pathology (See Berg, Peterson, Frazier, & Crow, 2012 for a review). The EDEQ includes 4 subscales (i.e., weight concern, shape concern, dietary restraint, and eating concern). In the current study, we used the total score as a measure of overall ED pathology. Within our sample this scale demonstrated excellent internal consistency (Cronbach’s $\alpha=.93$).

We also used this measure to determine ED diagnoses within our sample. Specifically, we used a diagnostic algorithm developed by Berg and colleagues (2012; see Table 1 in reference) that included items on the EDE-Q reflecting specific diagnostic criteria (i.e., overvaluation of shape and weight, binge eating behaviors, compensatory behaviors) as defined by the DSM-5 (APA, 2013). Our approach differed from that used by Berg and colleagues in the definition of low body weight. Instead of using the 85% ideal body weight cutoff, we used a BMI cutoff of less than 18.5. This specific procedure has been used in previous work (Cunningham et al., 2016).

**Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985).** The GLTEQ is a brief self-report measure designed to assess an individual’s physical fitness and activity level. Participants rated the frequency and intensity (i.e., mild, moderate, strenuous) of periods of exercise behaviors over a 7-day period. We computed total score by multiplying frequency ratings for moderate and strenuous
exercise by 5 and 7 respectively and summing these products. This method for computing total score has been shown to produce a represent index of physical exercise (Godin, 2011).

**Compulsive Exercise Test (CET; Taranis et al., 2011).** The CET is a 24-item self-report questionnaire designed to assess cognitive and behavioral components of CE. This measure consists of five subscales reflecting maintaining mechanisms of CE (i.e., compulsivity, affect regulation, and weight control exercise). The following are examples of items for each of the five subscales: avoidance and rule-driven behavior (e.g., I feel guilty if I miss an exercise session), weight control exercise (e.g., if I cannot exercise I fear I will gain weight), mood improvement (e.g., I feel happier and/or more positive after I exercise), lack of exercise enjoyment (e.g., I find exercise a chore), and exercise rigidity (e.g., my weekly pattern of exercise is repetitive). Respondents were asked to rate the degree to which each statement was true for them on a 6-point likert scale ranging from 0 (never true) to 5 (always true). Total score was computed as the mean of all items and was used in the current study as a measure of CE. This measure has demonstrated high reliability and validity in previous studies (Taranis et al., 2011). The total CET demonstrated high internal consistency in the present sample (Cronbach’s α=.90).

**Exercise Dependence Scale (EDS; Hausenblas et al., 2002).** The EDS is a 21-item self-report questionnaire that assesses physical and psychology symptoms of exercise dependence. Respondents rated each item using a 6-point likert scale ranging from 1 (never) to 6 (always). This scale includes three items for each of the seven subscales (i.e., tolerance, withdrawal, intention effect, lack of control, time, reductions in other activities, and continuance). Tolerance refers to the need for increased volume or
intensity of exercise to attain the desired psychological and physiological benefits and withdrawal refers to the presence of negative psychological and physiological symptoms (e.g., anxiety, fatigue) when unable to exercise or the presence of exercise to relieve or avoid withdrawal symptoms. Intention effect is defined by exercising more or for a longer period of time than originally intended. Lack of control over exercise refers to desire and inability to reduce the quantity or intensity of exercise and time refers to elevated time spent engaging in activities necessary to obtain exercise. The scale also measures reductions in social, occupational and recreational activities in order to exercise as reduction in other activities. Finally, the continuance subscale measures the extent to which an individual continues to exercise despite illness or injury caused by exercise. Total score was computed by summing all items with higher scores indicate greater levels of exercise dependence (Hausenblas et al., 2002) and was used as a measure of exercise dependence in this study. Previous research has supported the concurrent validity and reliability of the EDS (Hausenblas & Downs, 2002). This scale demonstrated internal consistency in the current sample (Cronbach’s α=.94).

Exercise Motivation Inventory (EMI; Markland & Ingledew, 1997). The EMI is a 51-item self-report questionnaire designed to assess psychological, fitness, health, interpersonal, and body-related motives for exercise reflecting various levels of self-determined motivation. The original measure included 3 or 4 items designed to assess each of the original 14 subscales. Participants were presented with the stem, “Personally, I exercise (or might exercise)…” and were asked to rate each of the 51 items on a 6-point likert scale ranging from 0 (not at all true of me) to 5 (very true for me). The following are examples of items assessing each of the original 14 subscales: Stress Management
(e.g., because it helps to reduce tension), **revitalization** (e.g., because it makes me feel good), **exercise enjoyment** (e.g., because I find exercising satisfying in an of itself), **challenge** (e.g., to give me personal challenges to face), **social recognition** (e.g., to gain recognition for my accomplishments), **affiliation** (e.g., to spend time with friends), **competition** (e.g., because I like trying to win in physical activities), **health pressures** (e.g., because my doctor advised me to exercise), ill-health avoidance (e.g., to prevent health problems), **positive health** (e.g., because I want to maintain good health), **weight management** (e.g., to help control my weight), **appearance** (e.g., to improve my appearance), **strength and endurance** (e.g., to get stronger), and **nimbleness** (e.g., to stay/become more agile). Internal consistency for the total EMI was high in the current sample (Cronbach’s $\alpha=.97$).

The original subscales of the EMI are associated with various forms of intrinsic and extrinsic motivations. For example, in a 2007 study, Ingledew and Markland found that social affiliation, challenge, and competition motives were associated with intrinsic motivation; positive health, stress management and nimbleness were associated with identified regulations; and appearance and weight management motives were associated with external and introjected regulations.

Although the original factor structure has been supported in community samples of men and women (Markland & Ingledew, 1997), it has not been examined in a sample of individuals with elevated ED pathology. Because the nature of exercise motives in this population may differ from the general population, the current study aimed to determine the factor structure of this measure in an ED sample.

**Participants**
Participants were 396 male \((n=120, 30.3\%\) and female \((n=271, 68.4\%\) undergraduate students. They were relatively young \((M \text{ age } = 18.72, SD = 1.36\) and the average body mass index (BMI) our sample was 25.86 \((SD = 5.05\). Participants self-identified as Caucasian \((n=181, 45.8\%\), Black or African American \((n=83, 21\%\), Asian \((n=63, 16.1\%\), Hispanic or Latino \((n=54, 13.7\%\), and as multiracial \((n=11, 2.7\%\). Four participants \((1\%)\) chose not to provide their race or ethnicity. Eating disorder diagnosis based on EDE-Q responses showed that this sample included two individuals with AN \((.5\%\), five with BN \((1.3\%\), eighty-nine individuals with BED \((22.5\%\), and three hundred individuals with OSFED \((75.8\%\). These diagnoses were based on responses from a self-report questionnaire and were used as a means of identifying individuals with probable eating disorders and elevated eating disorder symptomology. Our sample was highly active with an average GLTEQ score of 35.18 \((SD = 25.30; \text{Godin}, 2011)\).

**Statistical Analysis**

**Data preparation.** Survey data was exported from an online survey platform and was analyzed using SPSS 23.0. Participants with missing data on EDE-Q items necessary for the determination of ED diagnosis and those without height and weight data were excluded from analyses. Additionally, six participants chose not to indicate their sex. These participants were excluded from regression analyses in which gender was included as a covariate. We examined the nature of missing data on all other variables by investigating the proportion of missing data values and with Little’s Missing Completely at Random (MCAR) chi-square test. Based on recent guidelines, we replaced MCAR values with maximum likelihood estimates (Schafer & Graham, 2002). Complete data, including estimated missing values, were used for EFA analysis. Additionally, complete
data were used in computing subscale and total scores of the EDE-Q and total scores for the EDS and CET according to published guidelines.

Next we examined standardized scores of study variables to detect univariate outliers and deleted outlying values. We also computed Mahalanobis distance values to determine the presence of multivariate outliers. Univariate and multivariate outliers were deleted from subsequent analyses. We then examined the distributions of study variables to screen for normality. Variables demonstrating significantly non-normal distributions were transformed to meet assumptions of parametric statistical analyses (Tabachnick & Fidell, 2013).

**Planned analysis: Aim 1.** The first aim of this study was to examine the nature of exercise motives among individuals with elevated ED pathology through an EFA of the original 51 items of the EMI. Prior to conducting our EFA, we examined statistical assumptions and the factorability of our data. We determined linearity of these data by examining pairwise scatterplots of individual EMI items. Next we investigated multicollinearity and singularity by examining at the determinant of the inter-item correlation matrix and condition indices for individual items. We verified the factorability of these data by exploring inter-item correlations and the off-diagonal values of the anti-image correlation matrix. Some large inter-item correlations ($r < .30$) and small values of the off-diagonals of the anti-image correlation (absolute value $r < .30$) were necessary for EFA analyses. We then conducted Bartlett’s test of sphericity to test whether inter-item correlations were significantly different than zero. Finally, we conducted the Kaiser-Meyer-Olkin test of sampling adequacy. Based on an established cutoff, we concluded
that a statistic value greater than .6 indicated adequately factorable data (Kaiser, H. F., 1974).

We used principal axis factoring with a non-orthogonal promax rotation to allow for correlations among factors. To determine the most parsimonious and appropriate factor structure of the EMI in this sample, we examined eigenvalues of extracted factors, the scree plot, communalities, and the pattern matrix (Cattell, 1966; Field, 2009). Additionally, we conducted a parallel analysis to determine whether obtained factor eigenvalues were greater than eigenvalues obtained with randomly generated data (Horn, 1965). We used a cutoff value of .32 to identify significant factor coefficients (Tabachnick & Fidell, 2013) and factors with fewer than 2 items were determined to be unstable and were not retained in the final factor model (Pallant, 2007).

Following identification of a suitable model, we computed factor scores for each of the derived factors. As in the original EMI, higher factor scores reflected greater endorsement of specific exercise motive (Markland & Ingledew, 1997). Next we inspected standardized scores for univariate outliers and deleted outlying values. Variables with non-normal distributions were transformed.

**Planned analyses: Aims 2 & 3.** We conducted 3 multiple linear regression analyses to examine the importance of specific exercise motives in determining ED pathology, CE and exercise dependence. Prior to conducting these analyses we evaluated assumptions of regression analyses by examining histograms and normal probability plots to determine normality of regression variables; detrended probability-plots to determine normality of residuals; and Durbin-Watson tests for independence of errors (Durbin & Watson, 1951; Tabachnick & Fidell, 2013).
To examine the association between specific exercise motives and ED pathology we conducted a simultaneous multiple linear regression analysis with exercise motives as independent variables and EDE-Q global score as the dependent variable. We included BMI and gender as covariates in this model because these variables have been shown to be highly associated with ED pathology (e.g., Rø, Reas, & Rosenvinge, 2012; Lavender, De Young, & Anderson, 2010). Covariates were entered in the first step of the regression model followed by simultaneous entry of exercise motives. We examined model fit statistics to determine the extent to which our model accounted for variance in EDE-Q total scores and squared semi-partial correlation coefficients for each of the exercise motives were used indicators of the unique variance in ED pathology accounted for by independent variables.

CET and EDS total scores were each included as dependent variables in two separate models. In each of these models we included gender was included as a covariate based on established associations between each of these variables and forms of PE (e.g., Cunningham et al., 2016). This covariate was entered in the first step of the regression model, followed by simultaneous entry of specific exercise motives. We examined model fit statistics and squared semi-partial correlation coefficients to determine the proportion variance in CE an exercise dependence accounted for by specific exercise motives.

Results

Data Preparation

Survey data were exported from an online survey platform and analyzed using SPSS 23.0. Participants with missing data on EDE-Q items integral for the determination of ED diagnosis and those without height and weight data were excluded from analyses.
Exploration of the nature of missing data for remaining items of the EDE-Q, and all items on the EMI, CET and EDS indicated the low proportion of missing data (<5% for all scales). Additionally, Little’s Missing Completely at Random (MCAR) tests of the nature of missing data indicated that data on the EDEQ ($\chi^2 (558) = 566.74, p = .39$), EDS ($\chi^2 (318) = 315.94, p = .52$), and CET ($\chi^2 (412) = 435.08, p = .21$) were MCAR. Although the results of Little’s MCAR test for the EMI yielded significant results, $\chi^2 (3262) = 3641.25, p < .001$, this result was interpreted as reflecting the sensitivity of the $\chi^2$ test to sample size because the EMI includes 51 items, the chance of type II error in this test is inflated. Thus we determined that EMI data could be replaced due to the likely random pattern of missingness and the low proportion of missing values. Based on recent guidelines missing values were replaced with maximum likelihood estimates (Schafer & Graham, 2002). Complete data were used for EFA analysis and for computation of total scores for the EDE-Q, EDS, and CET were computed according to published guidelines.

Preliminary examination of EMI items and the total scores for EDE-Q, EDS, and CET indicated the presence of 9 univariate outliers ($z > 3.29$; Tabachnick & Fidell, 2013). Additionally, we discovered 40 multivariate outliers (Mahalanobis distance > 87.97, $p < .001$) based on a chi-square distribution with 51 degrees of freedom. We deleted outlying cases from subsequent analyses due to the established detrimental impact of outliers on the accuracy of statistical analyses (Barnett & Lewis, 1978). Following these deletions, 347 cases remained for analysis. To determine the approximate normality of study variables we examined skewness and kurtosis values, histogram and Q-Q plots. The Q-Q plots did not indicate significant deviations from normality and all skewness and kurtosis values were below 2.0, therefore we did not
transform and of the items of the EMI nor did we transform total scores for the EDE-Q, EDS, and CET.

Descriptive Statistics

Descriptive statistics for measures of ED pathology and PE within this sample are reported in Table 1. Within our sample of undergraduates with threshold and subthreshold ED diagnoses, mean EDE-Q global score was higher than values reported for this measure in research examining non-clinical undergraduate samples (Luce, Crowther, & Pole, 2008; Lavender et al., 2010) and lower than norms reported for clinical samples of young adult males and females (e.g., Mond et al., 2004). Mean scores on the EDS and CET were consistent with previous research examining these measurements in undergraduate samples with elevated ED pathology (e.g., Cook et. al., 2014, Taranis et al., 2011). Bivariate correlations between EDE-Q, EDS, and CET scores were consistent with findings from recent studies (e.g., Cunningham et al., 2016) and are presented in Table 1.

Primary Analyses

Aim 1.

Assumptions for EFA analyses. Our sample size of 347 was sufficiently large for EFA analyses based on published guidelines (Tabachnick & Fidell, 2013). In support of the linearity of these data, our examination of pairwise scatterplots from a sample of EMI items did not indicate the presence of curvilinear relationships between items. Next we assessed the factorability of these data through examination of the variable correlation matrix. Inter-item correlations were sufficiently large ($r < .30$); however, the determinant of the inter-item correlation matrix was very close to zero ($D < .001$), suggesting the
possible presence of multicollinearity. Further examination of condition indices showed that, for any single item, no two variance proportions were greater than the recommended cutoff of .5 (Tabachnick & Fidell, 2013). Bartlett’s test of sphericity indicated that the inter-item correlations were significantly different than zero ($\chi^2 (1275) = 18144.05, p < .001$) and the Kaiser-Meyer-Olkin (KMO) statistic supported the sampling adequacy of these data (KMO = .955). Most of the off diagonals in anti-image correlation matrix were small; however, we noted a few off-diagonal values in the anti-image correlation matrix that fell outside the recommended range (\(-.30 < r < .30\); Tabachnick & Fidell, 2013); however due to the small proportion of values falling outside this range we determined that these data were still factorable.

**Factor structure of EMI.** The first aim of this study was to examine the nature of exercise motives among individuals with elevated ED pathology. Our EFA with a principal axis factor extraction using a promax rotation yielded a 10-factor solution that represented a theoretically consistent and parsimonious model of specific exercise motives (Table 2). Each of the eigenvalues for the 10-factors was greater than the respective eigenvalue computed through parallel analysis; therefore we determined that this factor structure was superior to a structure based on random data (Horn, 1965). Because each of the ten factors included 4 or more items (Pallant, 2007), we retained all factors in our final model; however, we excluded one item (“to help me look younger”) from our final model because it did not load onto any factor above the .32 cutoff (Tabachnick & Fidell, 2013).

**Factor interpretation.** Although the factors generated through our analysis resembled the original structure of the EMI (Markland & Ingledew, 1997), our solution
was unique for individuals with elevated eating pathology. Factor one included 13 items related to psychological benefits of exercising from the original enjoyment, revitalization, stress reduction, and personal challenge subscales of the EMI. These items primarily reflected autonomous motives (e.g., for enjoyment of the experience of exercising itself); however, some items included in this factor reflected controlled motivations for exercise (e.g., to reduce tension). Despite the mixture of items reflecting controlled and autonomous motivations for exercise, we concluded that this factor primarily represented autonomous motives for exercise. We named this factor *psychological benefit.*

Factor two included the original four items of the EMI competition subscale reflecting exercising for competitive motives (e.g., because I like trying to win in physical activities) and reflected autonomous motivation. Factor three, *weight control,* was also consistent with an original subscale of the EMI. This motive for exercise reflected controlled motivation for exercise (Ingledew & Markland, 2007).

The fourth factor derived from our analysis included items from the positive health (e.g., because I want to maintain good health) and ill-health avoidance (e.g., to avoid ill-health) subscales of the original EMI. Consistent with prior work, we conceptualized this factor as reflecting autonomous motivations and because many of the items reflected an intention to promote positive health named this factor *positive health.* The fifth factor, *appearance improvement,* included 3 of the original 4 items on the appearance subscale of the EMI and reflected controlled motivation. We did not include the fourth item from the original subscale (“to make me look younger”) in our final model.
Factor six included all of the items from the original social affiliation EMI subscale and reflected autonomous motivations for exercise. We named our seventh factor illness prevention because it included a combination of items from the ill-health avoidance and health pressures subscales of the EMI that reflected exercising to reduce risk for health problems. Consistent with previous work, these motives (e.g., “because my doctor advised me to exercise”) were considered controlled motivations for exercise. The items included on factor eight reflected autonomous, skill development, motives and consisted of a combination of items from the original nimbleness and challenge subscales. Factor nine was named social recognition because it included many of the items from the original subscale of the EMI. This factor reflected controlled motivations for exercise (e.g., “to gain recognition for my accomplishments”). Finally, our tenth factor included items from the strength and endurance and nimbleness subscales of the EMI that reflected autonomous motivations for exercise. We named this factor strength and endurance.

In summary, we conceptualized our factors as reflecting various forms of motivations. Social affiliation, positive health, strength and endurance, skill development, competition and psychological benefit motives were conceptualized as reflecting autonomous motives for exercise whereas appearance improvement, weight control and social recognition motives reflected controlled motivations for exercise.

*Factor scores.* We computed factor scores based on the 10-factor structure attained through our EFA. Descriptive statistics and Cronbach’s alpha coefficients for each of the ten exercise motives are presented in Table 3. As in the original EMI, we interpreted higher scores as indicating greater endorsement of respective exercise motive
(Markland & Ingledew, 1997). Cronbach’s alpha coefficients ranged from .78 to .97 indicating high internal consistency for these factors within our sample.

Next, we examined the distributions of exercise motives to determine the appropriateness of these variables as predictors in subsequent multiple regression analyses. We deleted two univariate outliers and did not detect any multivariate outliers. Based on our examination of variable distribution histograms and normal probability plots, we determined that five variables, psychological benefit, positive health, weight control, appearance improvement, and strength and endurance were negatively skewed. These variables were reflected, square root transformed, and reflected again to allow for easier interpretation of regression coefficients (Tabachnick & Fidell, 2013). We then computed bivariate correlation coefficients for our final variables to determine the associations between different exercise motives (Table 4).

**Aims 2 & 3.**

*Assumptions of regression analyses.* Detrended normal probability plots and residual plots of all variables, including transformed variables, supported our assumption of normality of residuals. All values from Durbin-Watson tests for independence of errors were within the recommended range (greater than one and less than three; Durbin & Watson, 1951) and our examination of tolerance and variance inflation factor values provided indicated the absence of multicollinearity.

*Aim 2.* We first examined associations between specific exercise motives and ED pathology through a simultaneous multiple linear regression analysis. Our analyses yielded a significant final model $F(12, 323) = 20.63, p < .001, R^2 = .43, \text{Adjusted } R^2 = .41$. This model, including exercise motives, accounted for significantly more variation in
EDE-Q global score than the model containing only a constant and the covariates, BMI and gender, $\Delta F(10, 323) = 15.72, p < .001, \Delta R^2 = .28$. Table 5 displays standardized regression coefficients ($\beta$) and semi-partial correlation coefficients ($sr^2$) from this regression equation. In the final model, our covariates, BMI and gender, were significant predictors of EDE-Q global score. Of the exercise motives entered into the model, social recognition and weight control motives were positively related to ED pathology severity and the competition motive was negatively related to ED pathology.

**Aim 3.** Next we conducted two separate multiple regression analyses to determine which exercise motives were most associated with CE and exercise dependence. Our final model for CET, $F(11, 328) = 20.15, p < .001, R^2 = .50$, Adjusted $R^2 = .49$, accounted for significantly more variation in CET total score than the model containing only a constant and the covariate, $\Delta F(10, 328) = 32.82, p < .001, \Delta R^2 = .50$. Standardized regression coefficients ($\beta$) and semi-partial correlation coefficients ($sr^2$) from this regression equation are displayed in Table 6. In the final model, the covariate (i.e., gender) was a significant predictor of CET total score and psychological benefit, social recognition, and weight control motives were positively associated with CET scores. In this model, illness prevention and social affiliation motives were associated with lower CET scores.

The model for EDS total score, $F(11, 328) = 24.68, p < .001, R^2 = .45$, Adjusted $R^2 = .44$, was a significantly better fit than the model containing only a constant and the covariate, $\Delta F(10, 328) = 35.38, p < .001, \Delta R^2 = .42$. Table 7 displays standardized regression coefficients ($\beta$) and semi-partial correlation coefficients ($sr^2$) from this regression equation. In this model, psychological benefit, competition, and social
recognition motives were related to greater levels of exercise dependence whereas exercising for illness prevention and social affiliation were negatively associated with exercise dependence.

**Discussion**

This study aimed to examine the nature of motives for exercise among individuals with ED pathology. Due to the lack of validated and theoretically grounded measures of exercise motives among individuals with ED pathology, our first aim was to determine the factor structure of the EMI, a measure of exercise motives based on SDT, within an ED sample. We then used this measure of exercise motives to achieve our second and third aims. The second aim of this study was to examine the association between specific motives for exercise within our sample and severity of ED pathology. To do this, we examined unique associations between specific motives for exercise and overall ED pathology. Finally, to improve our understanding of exercise motives and PE among individuals with EDs, we explored the unique associations between various specific motives for exercise, CE, and exercise dependence.

**Measurement of Exercise Motives Among Individuals with ED Pathology**

Existing research examining exercise motives within the context of EDs is limited by inconsistent measurement of exercise motives and lack of a strong underlying theory of motivation. The present study aimed to establish a theoretically based measure of exercise motives among individuals with ED pathology. Our EFA of the EMI yielded ten distinct motives for exercise including (1) psychological benefits, (2) competition, (3) weight control, (4) positive health promotion, (5) appearance improvement, (6) social affiliation, (7) illness prevention, (8) skill development, (9) social recognition, and (10)
strength and endurance. Although our solution included several of the original factors proposed by Markland and Ingledew (1997), there were several notable differences within our ED sample. First, our results did not support the distinction between exercising for enjoyment, revitalization, personal challenge and stress management found in among adults without eating pathology (Markland & Ingledew, 1997). Rather, these four motives were highly inter-related and represented one factor (i.e., psychological benefits). This finding suggests that individuals with ED pathology simultaneously experience exercise as both positively reinforcing (i.e., enjoyment) and negatively reinforcing (i.e., relief from stress). We also did not include the nimbleness and flexibility subscales of the original EMI in our solution. Instead, items from these original subscales were included in the skill development and strength and endurance factors.

Regarding health-related motives, the original EMI contained three distinct subscales; however, our solution collapsed these scales into two factors. Although the two factors included items from each of the original three subscales, they reflected two different forms of health motivation for exercise. One factor included items reflecting motives to improve health and promote physical well-being (i.e., positive health), whereas the other factor included items reflecting a desire to prevent negative consequences (i.e., illness prevention). Items from the original health pressures subscale of the EMI did not represent a distinct factor, instead these items loaded onto the illness prevention factor in our sample. This finding was not surprising because the original health pressures subscale included only three items, each of which reflected exercising in order to avoid negative health consequences. Finally, we omitted one item from the original EMI that assessed exercising in order to appear younger. This item was neither
commonly endorsed in our sample nor related to other items in the measure. Our omission of this item makes sense given the nature of our sample (i.e., undergraduate students).

Consistent with previous research of the EMI (Ingledew & Marland, 2007; Markland & Ingledew, 1997) and other exercise motivation measures (see Teixeira et al., 2012 for review), each of the motives identified through our analyses reflected different levels of self-determined motivation. Exercising for psychological benefits, competition, social affiliation, skill development, and strength and endurance were autonomous motives for exercise. These factors included items reflecting integrated regulation, identified regulation, and intrinsic motivation. In contrast, social recognition, appearance improvement, and weight control motives reflected controlled motivation for exercise (i.e., external regulation and introjected regulation).

Next, we examined the mean rating for each of our derived exercise motives to determine the most commonly endorsed motives for exercise within our sample. On average, exercising for appearance improvement, weight control, positive health, and strength and endurance were more important reasons for exercise than illness prevention, social affiliation, and competition. These results align with existing research suggesting that individuals with elevated ED pathology exercise primarily for appearance and weight-related reasons (Bardone-Cone et al., 2016). Interestingly, exercise to promote positive health was one of the most common reasons for exercise whereas exercising to prevent illness was less common. This finding is interesting in the context of recent work indicating that health motives for exercise are less important for individuals with EDs (Bardone-Cone et al., 2016) and negatively associated with body dissatisfaction.
(Vartanian et al., 2012). Our findings suggest that, even for those with ED pathology, maintaining a healthy body and increasing feelings of health are important motives for exercise. In contrast, exercising due to pressure from doctors and to prevent negative health consequences are less important motives. Finally, to date, no research has examined the importance of competition, social affiliation, and strength and endurance motives for exercise among individuals with ED pathology. Our results suggest that improving strength and endurance is an important motive for exercise within this population whereas individuals with ED pathology are less motivated to exercise for competition and social affiliation.

**Exercise Motives and ED Pathology**

The second aim of the study was to examine associations between exercise motives and severity of ED pathology. Although several studies have explored associations between specific motives for exercise, body image, and ED pathology, these studies have primarily focused on appearance and weight-related motives for exercise and have inconsistently operationalized exercise motives. In the current study, we aimed to extend recent work by examining associations between ED pathology and theoretically based exercise motives. Based on findings from recent studies, we predicted that controlled motivations for exercise would be associated with increased ED pathology and autonomous motives would be negatively associated with ED pathology. In support of our hypotheses, two controlled motives for exercise (i.e., social recognition and weight control) were associated with greater levels of ED pathology and an autonomous motive (i.e., competition) was associated with decreased ED pathology. Of the motives associated with ED pathology, exercising for weight control was most strongly associated
with severity of ED pathology. These results are consistent with previous work that has established a positive association between weight control exercise and ED pathology (Bardone-Cone et al., 2016; Keyes et al., 2015). Additionally, our finding that exercising for social recognition is positively associated ED pathology aligns with other work that has established a link between negative psychological outcomes and exercising for social recognition (e.g., Ingledew & Markland, 2007). Our results also broadly align with work linking autonomous and controlled motives to differential psychological and behavioral outcomes. Specifically, our finding that controlled motives were associated with more severe ED pathology extends previous findings that controlled motives are associated with negative outcomes (e.g., Pelletier & Dion, 2007; Verstuyf, et al., 2012). Similarly, our finding that an autonomous motive (i.e., competition) was negatively related to ED pathology is consistent with previous findings showing that autonomous motives are associated with positive outcomes (e.g., Ingledew & Martin, 2007; Maltby & Day, 2001). Thus, our results extend support for the role of autonomous and controlled motives for exercise in determining positive and negative psychological consequences to include ED pathology.

Interestingly, many of the motives we examined were not associated with severity of ED pathology. Most notably, exercising to improve appearance was not associated with ED severity. This finding contrasts results from recent work that have shown a strong association between appearance improvement exercise and ED pathology (e.g., Keyes et al., 2015). There are several possible explanations for the lack relationship between appearance improvement exercise and ED pathology within our sample. First of all, exercising for appearance improvement is common among individuals with and
without ED pathology (Markland & Ingledew, 1997; Teixeira et al., 2012), thus it may be the case that this motive is important to everyone, regardless of severity of ED pathology. Alternatively, in this study, we examined the unique association between appearance improvement motives and ED pathology while controlling for weight control exercise. Therefore, it is plausible that appearance improvement motives for exercise are not truly associated with ED pathology and past associations between appearance improvement exercise and ED pathology have been inflated by the inclusion weight control components in definitions of appearance improvement motives.

We were also surprised by the lack of association between several autonomous motives for exercise and ED pathology. Existing work has established a positive association between exercising for autonomous motives (e.g., positive health, social affiliation, psychological benefit, etc.) and psychological well being, therefore we expected these motives to be associated with decreased levels of ED pathology. However, our findings suggest that these motives are less important than weight control, social recognition, and competition motives for exercise in determining severity of ED pathology. Future research should continue to examine relationships between these motives and ED pathology in order to further refine our understanding of associations between autonomous motives for exercise and ED pathology.

**Exercise Motives and PE**

The final aim of the current study was to explore associations between motives for exercise, CE, and exercise dependence among individuals with EDs. We hypothesized that autonomous motives for exercise, reflecting greater levels of intrinsic motivation, would be negatively associated with pathological exercise while controlled motives for
exercise were expected to be associated with higher levels of CE and exercise
dependence. Prior to the current study, only one study had examined associations
between specific exercise motives and PE in individuals with EDs. Keyes et al. (2015)
found associations between PE and exercising to improve appearance, mood, health, and
tone in a sample of individuals with EDs. Similarly, our results indicated that many
different motives for exercise were related to PE among individuals with EDs. Our
findings also extended the findings of Keyes et al. by examining a broader range of
motives for exercise based on SDT and by differentiating between two opposing model
of PE.

As we expected, controlled motives for exercise were positively associated with
CE and exercise dependence. Specifically, we found exercising for weight control was
associated with greater levels of CE. This result was consistent with existing research
linking controlled motives for exercise to negative psychological outcomes (Ingledew &
Markland, 2007) and to other recent work linking weight control exercise motives to CE
behaviors (Keyes et al., 2015). Additionally, in support of our hypothesis that controlled
motives for exercise would be related to increased PE, exercising for social recognition
was associated with greater CE and exercise dependence. Also in support of our
hypotheses, social affiliation and illness prevention motives for exercise were associated
with lower levels of CE and exercise dependence and competition motives were
negatively associated with exercise dependence. These finding suggests that exercising
for reasons that are personally meaningful (e.g., to foster social connection, for
enjoyment of competition, and to prevent negative health consequences) may be
protective against PE and align with existing work that has established a link between
autonomous motives and psychological well-being (Teixeira et al., 2012; Vallerand, 1997).

Consistent with many studies in the exercise literature that have linked exercising for autonomous motives (i.e., enjoyment, personal challenge) to positive psychological and behavioral outcomes, we predicted exercising for psychological benefits would be associated with lower levels of PE; however, contrary to our hypothesis, exercising for psychological benefit was positively associated with both CE and exercise dependence. This finding may be due to the nature of the measure of psychological benefit used in our study. Our preliminary analyses indicated that items reflecting exercising for enjoyment, revitalization, personal challenge, and stress management were highly inter-related and these items were all included on one, psychological benefit, factor. However, exercising for stress management may be best conceptualized as a controlled motive for exercise due to emphasis on the external contingencies (e.g., stress reduction) associated with exercise (Markland & Ingledew, 1997). Because we included stress management in our measure of psychological benefits, this factor may not have adequately reflected autonomous psychological motives for exercise. Furthermore, exercising to manage negative affect is central to the theories underlying both exercise dependence and CE (Hausenblas & Downs, 2002; Meyer et al., 2011), therefore the strong association between psychological motives and PE may reflect conceptual overlap between theories of PE and psychological motives. Hamer et al. (2002) came to a similar conclusion in their study of endurance athletes. This explanation is also consistent with recent research linking exercising for mood improvement and increased levels of PE in individuals with and without ED pathology (e.g., Cunningham et al., 2016; Keyes et. al., 2015). Our
finding, in combination with existing research suggests that, although exercising for psychological benefit is protective against most negative psychological consequences, relying on exercise as a means of coping with aversive psychological states is maladaptive when it manifests as PE.

As with ED pathology, several of the motives for exercise we examined were not associated with CE or exercise dependence. The aim of the current study was to explore the importance of specific motives in determining severity of PE, thus we did not expect all motives for exercise to be strongly related to PE. CE and exercise dependence were not associated with appearance improvement, positive health promotion, skill development, and strength and endurance motives. Additionally, exercising for weight control was not associated with exercise dependence whereas exercising for competition was not associated with CE. These findings suggest that these motives are less important in determining the nature of exercise behavior (i.e., PE or adaptive); however, it is also possible that the impacts of these motives were overshadowed by more important motives included in this study. Future research should continue to examine associations between these exercise motives and PE.

**Strengths and Limitations**

There were several strengths and limitations of the current study related to sample characteristics and methodology. Regarding sample characteristics, this study included data from a relatively diverse sample of male and female participants. This is a notable strength because it allows for generalizability of these findings to a broad range of individuals. Despite this notable strength, our sample consisted of undergraduate students demonstrating elevated ED pathology on a self-report measure rather than a clinical ED
Although study participants met criteria for threshold and subthreshold EDs based on an established diagnostic algorithm and reported experiencing significant ED symptoms, they may or may not have qualified for clinical ED diagnoses.

There were also strengths and weaknesses in the methodology used in this study. Our use of factor analytic procedures to determine the nature of theoretically based exercise motives enabled improved understanding of motivations for exercise in young individuals with elevated ED pathology. Additionally, we used measures of two distinct multi-dimensional theories of PE that allowed for improved understanding of associations between exercise motives and different forms of PE. Nonetheless, our study was cross-sectional and relied on self-report measures of study variables. Thus we were unable to determine whether or not a causal relationship exists between exercise motives, ED pathology, and PE. Finally, data from this study may have been impacted by response biases and other limitations associated with the use of self-report questionnaires.

Clinical Implications

Findings from this study suggest that, among individuals with elevated ED pathology, exercise motives play an important role in determining the severity of ED pathology and PE. More specifically, results from our study indicate that more intrinsic motivations for exercise are associated with decreased ED pathology and PE whereas extrinsic motives may be indicative of increased impairment. These results may be relevant to prevention, assessment, and treatment of PE among individuals with EDs because they contribute to our understanding of the nature of PE. For prevention and treatment programs, our findings suggest that emphasizing the importance of exercising as a means of gaining social connection, increasing feelings of health, and for enjoying
physical exertion and competition may promote development adaptive exercise behaviors. Conversely, among individuals at risk for or with elevated ED pathology and PE, exercising for weight control and recognition from social others should not be encouraged. Similarly, our findings may inform assessment of the nature of exercise behaviors in the context of EDs. In addition to assessing clients for the key components of PE, clinicians can inquire about other reasons for exercise in their patients. Identifying additional ways of differentiating between PE and adaptive exercise behaviors among individuals with EDs may increase clinician confidence in incorporating exercise into the treatment of EDs. Future research should continue to examine the role of exercise motives in the treatment of EDs to determine if different exercise motives impact response to incorporation of exercise into ED treatment.

**Conclusion**

Exercise behaviors are common among individuals with EDs; however, clinicians report struggling to differentiate between adaptive exercise and PE. Furthermore, much recent work has highlighted the persistence of PE and negative outcomes associated with these behaviors. Conversely, exercise may also be an important component in the treatment for EDs and represents a novel and promising treatment option. Therefore, it is important to improve our ability to differentiate between PE and adaptive exercise is to determine appropriate prevention and treatment interventions. Findings from this study provide support for the importance of motivations for exercise in determining the nature of exercise among individuals with EDs. Specifically, autonomous motives, which reflect exercising for personally meaningful reasons, were associated with lower levels of ED pathology and PE whereas controlled motives, which reflect exercising to attain external
rewards or to avoid negative consequences, were associated with more severe ED pathology and greater levels of PE. Clinicians should consider types of motivation when assessing the nature of exercise in clients with EDs and prevention and treatment interventions should promote autonomous motivations for exercise.
References


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doi:10.1007/BF02291575

doi:10.1002/eat.22354


Table 1

*Descriptive Statistics and Correlations of Measures of Eating Pathology and Problematic Exercise*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>Skew (SE)</th>
<th>Kurtosis (SE)</th>
<th>EDS</th>
<th>CET</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDE-Q</td>
<td>2.04 (1.21)</td>
<td>.50 (.13)</td>
<td>-.55 (.26)</td>
<td>.17*</td>
<td>.45*</td>
</tr>
<tr>
<td>EDS</td>
<td>50.82 (19.23)</td>
<td>.37 (.13)</td>
<td>-.57 (.26)</td>
<td>-</td>
<td>.67*</td>
</tr>
<tr>
<td>CET</td>
<td>11.47 (3.81)</td>
<td>.03 (.13)</td>
<td>-.31 (.26)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* EDE-Q = Eating Disorder Examination Questionnaire; EDS = Exercise Dependence Scale; CET = Compulsive Exercise Test.  
*p < .001
### Table 2

Factor Loadings for Exploratory Factor Analysis of Exercise Motivation Inventory Items with Promax Rotation

<table>
<thead>
<tr>
<th>Item</th>
<th>PB</th>
<th>C</th>
<th>WC</th>
<th>PH</th>
<th>AI</th>
<th>SA</th>
<th>IP</th>
<th>SD</th>
<th>SR</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>To release tension</td>
<td>1.06</td>
<td>-0.08</td>
<td>0.02</td>
<td>-0.18</td>
<td>0.01</td>
<td>-0.07</td>
<td>0.17</td>
<td>-0.03</td>
<td>-0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Because it helps reduce tension.</td>
<td>1.00</td>
<td>-0.13</td>
<td>-0.02</td>
<td>-0.12</td>
<td>0.00</td>
<td>-0.05</td>
<td>0.09</td>
<td>0.02</td>
<td>0.06</td>
<td>-0.03</td>
</tr>
<tr>
<td>To help manage stress.</td>
<td>0.99</td>
<td>-0.17</td>
<td>0.04</td>
<td>-0.16</td>
<td>0.03</td>
<td>0.05</td>
<td>0.15</td>
<td>0.06</td>
<td>-0.07</td>
<td>0.00</td>
</tr>
<tr>
<td>Because I enjoy the feeling of exerting myself</td>
<td>0.93</td>
<td>0.10</td>
<td>0.00</td>
<td>-0.10</td>
<td>-0.03</td>
<td>-0.17</td>
<td>-0.07</td>
<td>0.03</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>Because I find exercising satisfying in and of itself</td>
<td>0.91</td>
<td>0.14</td>
<td>0.01</td>
<td>-0.04</td>
<td>0.00</td>
<td>-0.13</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>For enjoyment of the experience of exercising</td>
<td>0.88</td>
<td>0.12</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.11</td>
<td>-0.09</td>
<td>-0.10</td>
<td>-0.07</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>To give me space to think</td>
<td>0.87</td>
<td>-0.24</td>
<td>-0.02</td>
<td>-0.05</td>
<td>-0.12</td>
<td>-0.07</td>
<td>0.13</td>
<td>0.02</td>
<td>0.23</td>
<td>-0.06</td>
</tr>
<tr>
<td>Because I feel at my best when exercising</td>
<td>0.86</td>
<td>-0.05</td>
<td>-0.02</td>
<td>0.05</td>
<td>0.02</td>
<td>0.02</td>
<td>-0.09</td>
<td>-0.03</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Because I find exercise invigorating.</td>
<td>0.80</td>
<td>0.28</td>
<td>0.03</td>
<td>-0.09</td>
<td>-0.02</td>
<td>-0.13</td>
<td>-0.03</td>
<td>-0.11</td>
<td>-0.06</td>
<td>-0.01</td>
</tr>
<tr>
<td>Because it makes me feel good</td>
<td>0.80</td>
<td>-0.03</td>
<td>-0.03</td>
<td>0.28</td>
<td>0.04</td>
<td>0.04</td>
<td>-0.20</td>
<td>-0.12</td>
<td>0.03</td>
<td>-0.05</td>
</tr>
<tr>
<td>To recharge my batteries</td>
<td>0.61</td>
<td>0.02</td>
<td>0.01</td>
<td>0.05</td>
<td>0.06</td>
<td>0.04</td>
<td>0.27</td>
<td>0.07</td>
<td>-0.10</td>
<td>-0.10</td>
</tr>
<tr>
<td>To give me personal challenges to face</td>
<td>0.46</td>
<td>0.27</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.10</td>
<td>-0.03</td>
<td>-0.04</td>
<td>0.37</td>
<td>-0.05</td>
<td>-0.04</td>
</tr>
<tr>
<td>To give me goals to work towards</td>
<td>0.44</td>
<td>0.15</td>
<td>0.03</td>
<td>0.07</td>
<td>-0.08</td>
<td>-0.07</td>
<td>-0.06</td>
<td>0.16</td>
<td>0.08</td>
<td>0.21</td>
</tr>
<tr>
<td>Because I enjoy competing</td>
<td>-0.06</td>
<td>0.98</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.07</td>
<td>-0.02</td>
<td>-0.03</td>
<td>-0.12</td>
</tr>
<tr>
<td>Because I enjoy physical competition</td>
<td>0.02</td>
<td>0.92</td>
<td>-0.01</td>
<td>-0.04</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.06</td>
</tr>
<tr>
<td>Because I like trying to win in physical activities</td>
<td>-0.09</td>
<td>0.86</td>
<td>0.04</td>
<td>-0.05</td>
<td>-0.04</td>
<td>0.02</td>
<td>0.06</td>
<td>-0.08</td>
<td>0.06</td>
<td>0.09</td>
</tr>
<tr>
<td>Because I find physical activities fun, especially when competition is involved</td>
<td>0.19</td>
<td>0.75</td>
<td>0.06</td>
<td>-0.04</td>
<td>0.03</td>
<td>0.09</td>
<td>-0.07</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>To lose weight</td>
<td>-0.06</td>
<td>0.03</td>
<td>0.97</td>
<td>-0.03</td>
<td>-0.13</td>
<td>-0.04</td>
<td>0.11</td>
<td>-0.05</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>To stay slim</td>
<td>0.02</td>
<td>0.01</td>
<td>0.76</td>
<td>0.18</td>
<td>0.06</td>
<td>-0.01</td>
<td>-0.17</td>
<td>0.03</td>
<td>0.08</td>
<td>-0.13</td>
</tr>
<tr>
<td>Because exercise helps me burn calories</td>
<td>0.13</td>
<td>0.01</td>
<td>0.75</td>
<td>-0.07</td>
<td>0.11</td>
<td>0.07</td>
<td>0.04</td>
<td>0.03</td>
<td>-0.03</td>
<td>0.07</td>
</tr>
<tr>
<td>To help control my weight</td>
<td>0.00</td>
<td>0.05</td>
<td>0.74</td>
<td>-0.03</td>
<td>0.18</td>
<td>-0.06</td>
<td>0.15</td>
<td>0.02</td>
<td>-0.08</td>
<td>-0.01</td>
</tr>
<tr>
<td>To avoid ill-health</td>
<td>0.06</td>
<td>-0.08</td>
<td>0.03</td>
<td>0.85</td>
<td>-0.07</td>
<td>0.05</td>
<td>0.02</td>
<td>0.07</td>
<td>0.03</td>
<td>-0.13</td>
</tr>
</tbody>
</table>
To prevent health problems | -.01 | .02 | .00 | .78 | .02 | -.04 | .20 | .04 | -.02 | .02 |
To have a healthy body | .17 | .01 | .05 | .58 | -.03 | -.04 | -.06 | -.12 | .08 | .32 |
Because I want to maintain good health | .21 | -.10 | -.04 | .52 | .05 | .06 | -.07 | -.05 | -.03 | .29 |
To feel more healthy | .27 | -.08 | -.01 | .37 | .21 | .06 | .05 | -.03 | -.09 | .29 |
To look more attractive | -.09 | .00 | .02 | -.08 | .94 | -.02 | -.06 | .06 | .09 | -.01 |
To improve my appearance | .04 | .01 | .07 | -.05 | .93 | .01 | -.05 | -.02 | -.03 | -.04 |
To have a good body | -.09 | .00 | .07 | .13 | .80 | -.01 | -.09 | -.04 | .02 | .06 |
To spend time with friends | -.17 | .00 | -.01 | .06 | -.09 | .85 | .04 | -.04 | .05 | .10 |
To have fun being active with other people | .11 | .08 | -.04 | -.02 | .11 | .84 | .00 | -.06 | -.06 | .01 |
To make new friends | -.05 | .20 | -.03 | -.12 | .04 | .74 | .09 | .04 | -.02 | .03 |
To enjoy the social aspects of exercising | .15 | .14 | .03 | -.11 | .64 | -.09 | .07 | -.01 | -.08 | .05 |
To help prevent an illness that runs in my family | -.01 | .13 | -.08 | .19 | -.02 | -.05 | .78 | -.11 | .03 | -.04 |
Because my doctor advised me to exercise | -.15 | -.08 | .25 | -.12 | -.17 | .10 | .62 | -.04 | .08 | .22 |
To avoid heart disease | .08 | .10 | -.03 | .40 | .10 | -.15 | .55 | .07 | -.07 | -.06 |
To help recover from an illness/injury | .10 | .20 | -.02 | .01 | -.09 | .22 | .50 | -.04 | .02 | -.05 |
To maintain flexibility | .02 | -.08 | -.01 | .02 | .02 | .02 | -.06 | .09 | 1.06 | -.07 | -.04 |
To stay/become flexible | -.06 | -.02 | .03 | .05 | .02 | -.04 | -.01 | .95 | -.08 | .01 |
To develop personal skills | .17 | .18 | -.02 | .09 | -.08 | .15 | .00 | .36 | .07 | .05 |
To show my worth to others | .08 | -.06 | .02 | .05 | .06 | .04 | -.04 | .09 | .79 | -.05 |
To compare my abilities with other peoples' | -.06 | .26 | .00 | -.03 | -.04 | -.08 | .05 | -.12 | .74 | .11 |
To gain recognition for my accomplishments | .12 | .23 | -.10 | .01 | .16 | .06 | .11 | .09 | .38 | -.09 |
To accomplish things others are incapable of | .24 | .27 | -.08 | -.07 | .08 | .00 | .09 | -.04 | .34 | .11 |
To measure myself against personal standards. | .32 | .18 | .05 | -.16 | .08 | .00 | -.16 | .15 | .34 | .06 |
To build up my strength | .16 | -.02 | .05 | .14 | -.11 | .03 | .00 | -.06 | .06 | .77 |
To get stronger | .29 | -.10 | -.04 | -.02 | .12 | .10 | .09 | -.05 | -.06 | .69 |
To develop my muscles | .38 | .03 | -.10 | -.11 | .19 | -.04 | .04 | .04 | -.05 | .57 |
To increase my endurance | .33 | -.03 | .02 | .14 | -.09 | .02 | -.07 | .22 | .03 | .42 |
To stay/become more agile | .06 | .21 | -.03 | .09 | .03 | -.09 | .07 | .30 | .01 | .33 |
To help me look younger  

<table>
<thead>
<tr>
<th></th>
<th>0.09</th>
<th>-0.25</th>
<th>0.09</th>
<th>0.25</th>
<th>0.06</th>
<th>0.13</th>
<th>0.16</th>
<th>0.18</th>
<th>0.30</th>
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<tbody>
<tr>
<td>Eigenvalue</td>
<td>22.88</td>
<td>5.04</td>
<td>3.03</td>
<td>2.33</td>
<td>1.64</td>
<td>1.30</td>
<td>1.24</td>
<td>1.06</td>
<td>0.89</td>
<td>0.82</td>
</tr>
<tr>
<td>Parallel Analysis Eigenvalue</td>
<td>0.98</td>
<td>0.90</td>
<td>0.83</td>
<td>0.78</td>
<td>0.73</td>
<td>0.69</td>
<td>0.65</td>
<td>0.61</td>
<td>0.57</td>
<td>0.54</td>
</tr>
</tbody>
</table>

*Note.* Factor loading > .32 are in boldface; PB = psychological benefit; C = competition; WC = weight control; PH = positive health promotion; AI = appearance improvement; SA = social affiliation; IP = illness prevention; SD = skill development; SR = social recognition; SE = strength and endurance.
Table 3

*Psychometric Properties of Exercise Motives*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\alpha$</th>
<th>$M$ (SD)</th>
<th>Skew (SE)</th>
<th>Kurtosis (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological Benefit</td>
<td>.97</td>
<td>3.01 (1.34)</td>
<td>-.54 (.13)</td>
<td>-.52 (.26)</td>
</tr>
<tr>
<td>Competition</td>
<td>.93</td>
<td>2.22 (1.56)</td>
<td>.20 (.13)</td>
<td>-1.04 (.26)</td>
</tr>
<tr>
<td>Weight Control</td>
<td>.91</td>
<td>3.53 (1.32)</td>
<td>-.81 (.13)</td>
<td>-.07 (.26)</td>
</tr>
<tr>
<td>Positive Health</td>
<td>.92</td>
<td>3.74 (1.09)</td>
<td>-.89 (.13)</td>
<td>.46 (.26)</td>
</tr>
<tr>
<td>Appearance</td>
<td>.92</td>
<td>4.15 (.95)</td>
<td>-1.17 (.13)</td>
<td>.90 (.26)</td>
</tr>
<tr>
<td>Social Affiliation</td>
<td>.91</td>
<td>2.31 (1.47)</td>
<td>-.06 (.13)</td>
<td>-1.01 (.26)</td>
</tr>
<tr>
<td>Illness Prevention</td>
<td>.78</td>
<td>2.10 (1.27)</td>
<td>.19 (.13)</td>
<td>-.65 (.26)</td>
</tr>
<tr>
<td>Skill Development</td>
<td>.87</td>
<td>2.96 (1.39)</td>
<td>-.38 (.13)</td>
<td>-.57 (.26)</td>
</tr>
<tr>
<td>Social Recognition</td>
<td>.86</td>
<td>2.49 (1.34)</td>
<td>-.03 (.13)</td>
<td>-.74 (.26)</td>
</tr>
<tr>
<td>Strength and Endurance</td>
<td>.93</td>
<td>3.52 (1.22)</td>
<td>-.82 (.13)</td>
<td>.11 (.26)</td>
</tr>
</tbody>
</table>
Table 4

*Intercorrelations Between Exercise Motives*

<table>
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<tr>
<th>Factor</th>
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<th>3</th>
<th>4</th>
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<th>7</th>
<th>8</th>
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<tbody>
<tr>
<td>Psychological Benefits</td>
<td>.57*</td>
<td>.25*</td>
<td>.72*</td>
<td>.38*</td>
<td>.55*</td>
<td>.49*</td>
<td>.69*</td>
<td>.70*</td>
<td>.79*</td>
</tr>
<tr>
<td>Competition</td>
<td>-</td>
<td>.04</td>
<td>.33*</td>
<td>.10</td>
<td>.69*</td>
<td>.41*</td>
<td>.51*</td>
<td>.67*</td>
<td>.52*</td>
</tr>
<tr>
<td>Weight Control</td>
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<td>.37*</td>
<td>.57*</td>
<td>.01</td>
<td>.31*</td>
<td>.26*</td>
<td>.20*</td>
<td>.27*</td>
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</tr>
<tr>
<td>Positive Health</td>
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<td>.48*</td>
<td>.39*</td>
<td>.50*</td>
<td>.62*</td>
<td>.46*</td>
<td>.77*</td>
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<tr>
<td>Appearance Improvement</td>
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<td>.04</td>
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<td>.36*</td>
<td>.50*</td>
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<tr>
<td>Social Affiliation</td>
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<td>.54*</td>
<td>.60*</td>
<td>.44*</td>
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<tr>
<td>Illness Prevention</td>
<td>-</td>
<td>.56*</td>
<td>.47*</td>
<td>.42*</td>
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<tr>
<td>Skill Development</td>
<td>-</td>
<td>.57*</td>
<td>.66*</td>
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<tr>
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<td>-</td>
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<tr>
<td>Strength and Endurance</td>
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</tbody>
</table>

* p < .01.
Table 5

*Multiple Linear Regression Predicting Eating Disorder Pathology From Exercise Motives*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>LL</th>
<th>UL</th>
<th>β</th>
<th>p</th>
<th>sr²</th>
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</tr>
<tr>
<td>Gender</td>
<td>.40</td>
<td>.15</td>
<td>.65</td>
<td>.15</td>
<td>&lt; .001</td>
<td>.02</td>
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*Note. N = 336; CI = Confidence Interval; LL = lower limit; UL = upper limit.*
Table 6

*Multiple Linear Regression Predicting Compulsive Exercise From Exercise Motives*

<table>
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<tr>
<th>Variable</th>
<th>B</th>
<th>LL</th>
<th>UL</th>
<th>β</th>
<th>p</th>
<th>sr²</th>
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*Note. N = 340; CI = Confidence Interval; LL = lower limit; UL = upper limit.*
Table 7

*Multiple Linear Regression Predicting Exercise Dependence From Exercise Motives*

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</tbody>
</table>

*Note.* N = 340; CI = Confidence Interval; LL = lower limit; UL = upper limit.