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The moderating effect of gender on ideal-weight goals and exercise dependence symptoms

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Background and aims: Exercise dependence is implicated in the development of eating disorders and muscle dysmorphic disorder. Although conceptually these disorders represent similar pathologies they largely affect different genders and result in opposite body composition, appearance, and ideal-weight goals (i.e., to gain or lose/maintain weight). Therefore, understanding individuals' ideal-weight goals related to engaging in exercise while simultaneously examining gender differences in exercise dependence symptoms may help to identify those whom may be most at-risk for eating disorders and muscle dysmorphic disorder. The purpose of our study was to examine the moderating effect of gender for exercise dependence symptoms in relation to weight gain, loss, or maintenance goals. *Methods:* Self-reported exercise behavior and exercise dependence symptoms (i.e., Exercise Dependence Scale) were assessed in 513 undergraduate students. *Results:* Our analysis revealed a moderating effect for gender on ideal-weight goals and a gender difference in exercise dependence symptoms. Specifically, men who were dissatisfied with their current weight reported more exercise dependence symptoms than women. *Conclusions:* These results support a growing body of research and extend our understanding of the relationships among exercise dependence and gender specific body-focused psychiatric disorders.

Keywords: exercise dependence, eating disorders, body size, moderator, gender

INTRODUCTION

Since the 1970s there has been increased research and clinical interest in the negative aspects of exercise dependence (also termed excessive exercise, obligatory exercise, exercise addiction, running dependence, commitment to exercise, and fitness fanaticism) that may result in serious health detriments (Baekeland, 1970; Cook & Hausenblas, in press; Hausenblas & Symons Downs, 2002a). On aggregate this research has contributed to our understanding of the physical and psychological characteristics that differentiate increased amounts of exercise from exercise dependency. For example, exercise dependence symptoms, as opposed to exercise amount, are implicated in the development and maintenance of both eating disorders (Bratland-Sanda, Martinsen, Rosenvinge, Rø, Hoffart & Sundgot-Borgen, 2011; Cook & Hausenblas, 2011; Cook, Hausenblas, Tuccitto & Giacobbi, 2011) and drive for muscularity (Chittester & Hausenblas, 2009). High amounts of drive for muscularity are predictive of muscle dysmorphia (Robert, Munroe-Chandler & Gammage, 2009). Although exercise dependence symptoms are implicated in both muscle dysmorphia and eating disorders, the physique ideals of these two disorders are polar opposites. That is, muscle dysmorphic individuals want to gain weight, in particular muscular mass, while eating disordered individuals want to lose/maintain weight. Despite that male populations are more at-risk for muscle dysmorphia and female populations are more at-risk for eating disorders (American Psychological Association [APA], 2000; Pope, Gruber, Choi, Olivardia & Phillips, 1997), there is no clear understanding of how exercise dependence and gender may relate to ideal weight goals and contribute to the development of these body-focused pathologies.

Research examining exercise dependence has focused on either primary or secondary exercise dependence. Primary exercise dependency is defined as when the individual meets the criteria for exercise dependence and continually exercises solely for the psychological gratification resulting from the exercise behavior (De Coverley Veale, 1987). Secondary exercise dependence is defined as occurring when an exercise dependent individual uses excessive exercise to accomplish some other end such as weight loss (Hausenblas & Fallon, 2002; Hausenblas & Symons Downs, 2002a). While the health detriments experienced in primary exercise dependence are significant (e.g., physical functioning detriments and increased bodily pain; Cook & Hausenblas, 2010), secondary exercise dependence occurs in conjunction with other pathologies, specifically eating disorders or muscle dysmorphia, and presents additional and more severe physical and psychological consequences (Pope et al., 1997; Sobel, 2004).

Research examining gender differences for exercise dependence has yielded conflicting results. Initially researchers guided their study designs using the rationale that high amounts of running are often observed in women with eating disorders. Not surprisingly, a gender difference indicating that women report higher exercise dependence symptoms than men has been observed (Masters & Lambert, 1989;

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Pierce, Rohaly & Fritchley, 1997). As well, researchers have found a gender difference indicating that women with primary exercise dependence, who also exercise for weight control, report more exercise dependence symptoms than men (Grandi, Clementi, Guidi, Benassi & Tossani, 2011; Kjelsas & Augustad, 2003). Conversely, several studies using undergraduate college students and middle aged adults have found that men are more likely to be "at-risk" for exercise dependence and report higher total symptoms scores than women (Hausenblas & Fallon, 2002; Hausenblas & Symons Downs, 2002b; Weik & Hale, 2009). Finally, Grandi et al. (2011) reported no significant gender difference in adults with primary exercise dependence. Thus, the literature to date lacks a clear consensus on differences and/or the moderating effect of gender in exercise dependence.

The existing literature, while equivocal (Szabo, 2000), provides only a general understanding of potential gender differences for exercise dependence. The lack of consensus of the direction of gender differences in exercise dependence passively suggests that other factors (i.e., primary vs. secondary exercise dependence; weight goals) may help explain how exercise dependence may exacerbate specific body-focused pathologies (Hausenblas & Fallon, 2002). For example, exercise may alter caloric balance and thus help individuals manage their weight and attain specific aesthetic outcomes (United States Department of Health and Human Services [USDHHS], 2008). Such body-weight changes may then more closely match cultural ideals of muscularity for men (Pope, Phillips & Olivardia, 2000) and lean/fit body types for women (Thompson, Heinberg, Altabe & Tantleff-Dunn, 1999). Therefore, the ambiguous gender findings to date may be better explained by concurrently examining exercise dependence symptoms and body-weight change goals. The conflicting gender differences for exercise dependence may in part be explained by the fact that eating disorders primarily affect women (APA, 2000) and muscle dysmorphia primarily affects men (Pope et al., 1997).

Including ideal body-weight goals and exercise has been investigated in either women trying to lose weight (e.g., Bamber, Cockerill & Carroll, 2000; 2003; Klein et al., 2004) or men lifting weights to gain weight (e.g. Smith, Hale & Collins, 1998), but no known studies to date have directly compared these different populations. Simply stated, conceptually men who engage in increased amounts of exercise with the intent of gaining weight and women who engage in increased amounts of exercise with the intent to lose weight are two symmetrical ends of a continuum of exercise dependence's affect on body-weight focused pathologies (see Figure 1). However, no study has compared exercise dependence symptoms and ideal-weight goals in these two similar, yet opposite ends of this continuum. Therefore, the purpose of our study was twofold. First, our primary purpose was to examine the potential moderating effect of gender on weight goals. Moderation is important in understanding why muscle dysmorphia and eating disorders disproportionally affect each gender and may add context to understanding other factors (e.g., exercise dependence) associated with the development of these disorders. Therefore, our secondary purpose was to examine gender differences in exercise dependence. Because exercise dependence has been implicated in the development of muscle dysmorphia via drive for muscularity (Chittester & Hausenblas, 2009; Robert et al., 2009) and eating disorders (Bratland-Sanda et al., 2011),

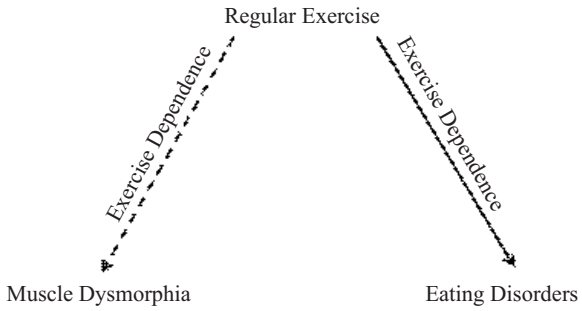

Figure 1. Conceptual model of gender difference in body-focus pathology outcomes in relationship to exercise dependence

Note: Dashed line = men, solid line = women.

we hypothesized that no gender difference for exercise dependence symptom scores would exist for men exercising to gain weight and women exercising to lose weight (Szabo, 2000).

METHODS

Participants

Following review and approval by the University's Institutional Review Board, questionnaire data on demographic variables, exercise behavior, and exercise dependence symptoms were obtained from 513 normal weight university students (*M* age =19.88, *SD* = 1.30; 76.22% women; 59.65% Caucasian; body mass index (BMI; kg/m^2) *M* = 23.60, *SD* = 3.40) recruited from a large southeastern university.

MEASURES

Demographic Questionnaire

The Demographic Questionnaire assessed the participant's age, gender, current weight, ideal weight, height, eating disorder history, and ethnicity. The difference between current and ideal weight were used to determine the participant's body-weight ideal goal categories described below. Current weight and height were used to compute body mass index.

Exercise Dependence Scale

The conceptually-based 21-item Exercise Dependence Scale (Hausenblas & Symons Downs, 2002b) assesses exercise dependence symptoms on the following seven subscales: Tolerance (e.g., I continually increase my exercise frequency to achieve the desired effects/benefits), Withdrawal Effects (e.g., I exercise to avoid feeling tense), Continuance (e.g., I exercise despite persistent physical problems), Lack of Control (e.g., I am unable to reduce how intense I exercise), Reductions in Other Activities (e.g., I think about exercise when I should be concentrating on school/work), Time (e.g., I spend a lot of time exercising), and Intention (e.g., I exercise longer than I expect). Items are measured on a 6-point Likert scale ranging from 1 (never) to 6 (always), with lower scores revealing less exercise dependence symptoms. The psychometric properties of this scale are excellent (Hausenblas & Symons Downs, 2002b; Symons Downs, Hausenblas & Nigg, 2004); and in this study the internal consistency was .94.

Leisure-time Exercise Questionnaire

The Leisure-time Exercise Questionnaire is a self-report of the frequency and duration that an individual engages in strenuous, moderate, and mild bouts of exercise during a typical week (Godin & Shephard, 1985). Each of the intensity scores are converted into metabolic equivalents (METS; [Mild × 3] + [Moderate × 5] + [Strenuous × 9]) and summed to provide an estimate of total METS expenditure from exercise for an average week. The LTEQ is a valid and psychometrically sound measure that is frequently used to assess exercise behavior. The MET values for the Leisure-time Exercise Questionnaire are based on published reports of its validity (e.g., Godin & Shephard, 1985; Jacobs, Ainsworth, Hartman & Leon, 1993), and this measure is considered the gold standard for self-report exercise assessment (Courneya, Jones, Rhodes & Blanchard, 2003). Minutes engaged in mild exercise were not used in these analyses, but the category was included in the questionnaire to ensure that participants did not report mild exercise minutes in the moderate intensity category (Haskell et al., 2007). Our interest in only moderate and strenuous exercise minutes is based on the public health recommendations that moderate to strenuous intensity activity is required to obtain health benefits (USDHHS, 2008).

Procedure

Data collection and analysis

Participants were recruited through announcements made in undergraduate level classes. The announcements stated this was a study examining the relationship between exercise and physical and psychological health outcomes. Participation was anonymous, voluntary, and the students were free to stop at any time. Study packets were distributed in individual folders that contained two copies of the informed consent sheet and one survey. All participants were asked to read the informed consent before beginning the survey and keep one copy for their records. Surveys were completed in class. Participants immediately placed completed surveys in a sealable folder then handed the folder to the first author. The survey took about 15 minutes to complete.

Participants were grouped into the following six weight-ideal categories based on gender and difference in current and ideal weight: a) men who wanted to gain weight (n = 49), b) women who wanted to gain weight (n = 38), c) men who wanted to maintain their current weight (n = 22), d) women who wanted to maintain their current weight (n = 49), e) men who wanted to lose weight (n = 51), and f) women who wanted to lose weight (n = 304). ANOVAs and ANCOVAS were used to examine potential gender differences for BMI, moderating effect of gender on weight change intention, amount of moderate exercise, amount of strenuous exercise, and total Exercise Dependence Scale scores.

RESULTS

Mean and standard deviation scores for all measures are presented in Table 1. One-way ANOVA revealed significant differences among BMI in each weight-ideal group [F(5, 507) = 32.40, p = .01]. A Tukey Post Hoc analyses revealed the following group differences among BMI: men who wanted to gain weight had a significantly higher BMI than women who wanted to gain weight (p = .01) and women who wanted to maintain their current weight (p = .01), but significantly lower BMI than men who want to lose weight. Women who wanted to gain weight had a significantly lower BMI than men who wanted to maintain their current weight (p = .01), men who wanted to lose weight (p = .01), and women who wanted to lose weight (p = .01). Men who wanted to maintain their current weight had a significantly higher BMI than women who wanted to maintain their current weight (p = .01). Men who wanted to lose weight had a significantly higher BMI than women who wanted to maintain their current weight (p = .01) and women who wanted to lose weight (p = .01). Women who wanted to lose weight had a significantly higher BMI than women who wanted to maintain their current weight (p = .01).

The potential moderating effect of gender on weight ideals (i.e., gain, maintenance, or lose weight) on exercise dependence symptoms was examined using a 2 (gender) × 3 (weight ideal group: weight gain, loss, or maintenance) ANOVA with exercise dependence symptoms as the dependent variable and gender and weight-ideal goal category as the independent variables. The intercept revealed a significant effect [F(1, 493) = 2570.09, p =.01], thus suggesting a moderating effect of gender on weight change intention.

Separate ANOVAs were run on moderate exercise and strenuous exercise. A 2 (gender) × 3 (weight-ideal) ANOVA revealed no significant effects for moderate level intensity exercise [F(1, 505) = 0.41, p = .53]. However, the intercept of gender and weight change intention was significant [F(1, 505) = 465.48, p = .01], thus suggesting a moderating effect of gender. Furthermore, a 2 (gender) × 3 (weight-ideal) ANOVA revealed significant effects for strenuous level intensity [F(1, 506) = 22.54, p = .01]. Bonferroni Post Hoc analyses revealed that all participants who want to gain weight reported significantly higher amounts of strenuous exercise than women who want to lose weight (p = .04).

Table 1. Study outcomes means and standard deviations – M *(SD)*

Measure	Men who want to gain weight n = 49	Women who want to gain weight n = 38	Men who want to maintain current weight n = 22	Women who want to maintain current weight n = 49	Men who want to lose weight n = 51	Women who want to lose weight n = 304
Moderate exercise	15.71 (11.55)	14.73 (11.6)	15.23 (7.93)	11.94 (11.94)	12.06 (13.86)	15.13 (10.53)
Strenuous exercise	32.69 (17.30)	14.35 (16.08)	26.59 (14.02)	19.65 (16.19)	23.82 (17.06)	19.37 (15.74)
Total exercise	48. 41 (23.13)	29.08 (20.26)	41.82 (17.88)	31.59 (20.55)	35.88 (22.20)	34.57 (21.17)
EDS	55.70 (18.30)	38.02 (18.23)	46.71 (11.64)	44.98 (13.96)	48.38 (12.83)	45.35 (15.32)
BMI	23.54 (3.16)	20.03 (1.79)	24.34 (2.22)	20.51 (1.64)	26.44 (2.70)	24.03 (3.29)

Note: EDS = Exercise Dependence Scale total score; BMI = Body Mass Index.

Moreover, the intercept of gender and strenuous exercise was significant [$F(1, 506) = 609.20$, $p = .01$], thus suggesting a moderating effect of gender.

A 2 (gender) × 6 (weight-ideal) ANCOVA was conducted to examine potential gender differences among exercise dependence scores while controlling for BMI as a covariate. Significant differences among group and exercise dependence scores were found [$F(6, 490) = 5.05$, $p = .01$]. Bonferroni Post Hoc analyses revealed the following group differences: Men who wanted to gain weight had significantly higher exercise dependence scores than women who wanted to gain weight ($p = .01$), women who wanted to maintain their current weight ($p = .02$), and women who wanted to lose weight ($p = .01$).

DISCUSSION

The purpose of our study was to examine the effect of gender for exercise dependence symptoms in relation to either weight gain or weight loss goals. Three main findings were observed in relation to our study purpose. First, contrary to our hypothesis (Szabo, 2000), a gender difference for exercise dependence scores was observed. Specifically, our results support previous research findings that men reported higher scores on total exercise dependence symptoms (Hausenblas & Symons Downs, 2002b). Second, gender was found to moderate desire to gain, maintain, or lose weight. Third, gender differences were also observed for intensity of exercise. That is, gender moderated differences in moderate and strenuous intensity exercise. The implications of our study findings, study limitations, and future research directions are discussed below.

First, our study provided additional evidence supporting the finding that men report more exercise dependence symptoms than women (Hausenblas & Symons Downs, 2002b; Weik & Hale, 2009). Confirmation of this gender difference is important because it indicates that sample characteristics may have more influence on exercise dependence status than previously thought. That is, our sample was composed of generally healthy undergraduate students. This is similar to the sample and male gender difference observed by Hausenblas and Symons Downs (2002b). Furthermore, Weik and Hale (2009) observed the same gender difference in a sample of healthy adult exercisers. Conversely, studies that have observed the opposite direction of a gender difference, with women reporting higher exercise dependence scores than men have primarily sampled female distance runners (Masters & Lambert, 1989; Pierce et al., 1997). Taken together, these results underscore the need to further examine exercise dependence in various samples while accounting for primary and secondary exercise dependence (Hausenblas & Fallon, 2002).

Moreover, an interesting finding of our study was that almost six times as many women ($n = 304$) than men ($n = 51$) wanted to lose weight, yet men reported higher exercise dependence scores. The disproportionate amount of women in our sample wishing to lose weight may illustrate the pressure experienced by women to conform to the sociocultural ideal standard of a lean and toned physique. Our observed moderating effect of gender on weight change intention supports social cognitive explanations of weight and body image related pathology (Levine & Smolak, 2006). Taken with our exercise dependence findings, this moderating effect may also suggest that intervening on exercise dependence may help ameliorate the development of an eating disorder in women and drive for muscularity in men (Chittester & Hausenblas, 2009; Cook & Hausenblas, 2008; Fairburn & Bohn, 2005; Fairburn, Cooper & Shafran, 2003; Hay & Fairburn, 1998).

Our cross-sectional design precludes any direct inferences, however the gender difference indicating an increased emphasis on strenuous exercise by men observed in our study suggests that women desiring to lose weight may be turning to other methods of weight control. Men may be altering calorie expenditure with increased amounts of strenuous exercise (Pope et al., 2000), while women may be using less intense bouts of exercise as only one of several compensatory behaviors undertaken in an attempt to lose weight (Tylka & Subich, 2002). This may have implications in the disproportionate attention paid to eating disorder prevention over muscle dysmorphia. Thus, future researchers are encouraged to examine all compensatory behaviors used for weight control in conjunction with exercise dependence.

Second, our results may indicate where interventions may be directed for eating disorder prevention. Specifically, the continuum model of eating disorders states that the behaviors and attitudes, such as body dissatisfaction, over concern about weight and shape, and excessively exercising, observed in full threshold eating disordered individuals begins with less severity and progresses linearly, culminating in either anorexia or bulimia nervosa (Fairburn & Bohn, 2005; Fairburn et al., 2003; Hay & Fairburn, 1998). Furthermore, compensatory behaviors may cause serious health detriments prior to the development of eating disorders (Sobel, 2004). Thus, our results provide a further understanding of how exercise dependence may contribute to the progression of eating pathology in women that are exercising to lose weight.

Similarly, dissatisfaction with musculature is a common specific feature of body dysmorphic disorder (Pope et al., 2000). Because of exercise's ability to increase muscle size and appearance, individuals with muscle dysmorphia may experience an increased drive for muscularity. Dissatisfaction with musculature, resulting in feeling unacceptably small, is the main source of body-image disturbance in men (Pope et al., 2000). Similar to anorexia (Pope, Katz & Hudson, 1993), there is a positive predictive relationship between muscle dysmorphia and social physique anxiety (Ebbeck, Watkins, Concepcion, Cardinal & Hammermeister, 2009; Grieve, Jackson, Reece, Marklin & Delaney, 2008), depression (Ebbeck et al., 2009), and perfectionism (Kuennen & Waldren, 2007) and a negative predictive relationship with perceived body attractiveness (Ebbeck et al., 2009). Thus, our finding of a gender difference indicating that men who exercise to gain weight exhibit more exercise dependence symptoms than women who exercise to lose weight provides insight into relationships among gender, eating pathology, and compensatory behaviors.

Cultural body image ideals emphasize muscularity for men (Pope et al., 2000) and a thin/lean ideal for women (Thompson et al., 1999). Excessive preoccupation with attaining such ideals and an individual's subjective, often biased, evaluation of their own appearance may lead to compensatory behaviors in an attempt to alter one's body composition to more closely match that ideal. The relationship between body mass and body-image disturbance is two-fold (Kostanski, Fisher & Gullone, 2004; Presnell, Bearman & Stice, 2004), such that people either have a self-perception that they are: (a) too heavy, which results in simultaneous

drives to lose body fat and add muscle; or (b) too thin, which results in a drive for muscularity. This was observed in our sample and supported by gender moderating weight gain or loss intentions. Thus, our results may offer insights into where to direct interventions to halt the increased amounts of exercise that accompany exercise dependence. Specifically, the gender difference observed in our study challenges the conventional notion to focus interventions on women increasing exercise amounts that may possibly exacerbate eating disorder progression. Our results suggest that men should also be screened for exercise dependence in an attempt to intervene on the progression of muscle dysmorphia. Moreover, Chittester and Hausenblas (2009) found that drive for muscularity is predicted by supplement use and exercise dependence. Thus, the pathological role of exercise may lead to exercise dependence (Hausenblas & Symons Downs, 2002a; Smith et al., 1998) and the associated physical and psychological difficulties (e.g., withdrawal symptoms, decreased time spent with family or friends, overuse injuries; Andersen, Cohn & Holbrook, 2000; Pope et al., 2000).

Several limitations were present in our study. First, our cross-sectional design precludes any inference into the temporal order of exercise dependence and development of associated pathologies. Second, these data were analyzed from a larger study (Cook et al., 2011) and therefore accurate measurement of variables such as eating disorder status and muscle dysmorphia status were not available. Finally, previous research comparing methods of assessing exercise dependence have also found that gender differences of men reporting higher amounts of symptoms are more common when assessing with the Exercise Dependence Scale (Weik & Hale, 2009). Therefore, future studies are encouraged to longitudinally examine exercise dependence, while controlling for co-morbid psychiatric disorders, and use multiple assessment tools that may discern primary and secondary dependence.

In conclusion, our study extends the literature by examining aspects related to primary versus secondary dependence and gender differences in exercise dependence. Taken together, our observed moderation effect of gender, exercise intensity, and exercise dependence gender differences, and understanding of cultural standards of masculine and feminine body ideals supports previously reported similarities among eating disorders and muscle dysmorphia (Pope et al., 1993). Specifically, our results add context to similarities of both disorders despite obvious differences in body ideals, compensatory behaviors, and disproportionate prevalence rates among gender. Thus, this study begins to synthesize our understanding of eating disorders in women and muscle dysmorphia in men by identifying gender as a moderator and exercise dependence as a common feature that may exacerbate the development of each disorder. Future research is encouraged to continue to examine potential gender differences in conjunction with motivation for body composition goals and associated psychiatric pathologies. Continued examination of the correlates of exercise dependence may provide better insights as to where interventions that may halt the progression of more serious secondary disorders may be directed.

REFERENCES

American Psychological Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. Text revision). Washington, DC: Author.

Andersen, A., Cohn, L. & Holbrook, T. (2000). *Making weight: Men's conflicts with food, weight, shape & appearance.* Carlsbad, CA: Gurze Books.

Baekeland, F. (1970). Exercise deprivation: Sleep and psychological reactions. *Archives of General Psychiatry, 22,* 365–369.

Bamber, D., Cockerill, I. M. & Carroll, D. (2000). The pathological status of exercise dependence. *British Journal of Sports Medicine, 34,* 125–132.

Bamber, D., Cockerill, I. M. & Carroll, D. (2003). Diagnostic criteria for exercise dependence in women. *British Journal of Sports Medicine, 37,* 393–400.

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

Chittester, N. I. & Hausenblas, H. A. (2009). Correlates of drive for muscularity: The role of anthropometric measures and psychological factors. *Journal of Health Psychology, 14,* 872–877.

Cook, B. & Hausenblas, H. (2010). Gender differences in exercise dependence's affect on quality of life. *Annals of Behavioral Medicine, 39,* S101.

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

Cook, B. J. & Hausenblas, H. A. (2008). The role of exercise dependence for the relationship between exercise behavior and eating pathology: Mediator or moderator? *Journal of Health Psychology, 13,* 495–502.

Cook, B. J. & Hausenblas, H. A. (2011). Eating disorder specific health-related quality of life and exercise in college females. *Quality of Life Research, 20,* 1385–1390.

Cook, B. J., Hausenblas, H. A., Tuccitto, D. & Giacobbi, P. (2011). Eating disorders and exercise: A structural equation modeling analysis of a conceptual model. *European Eating Disorders Review, 19,* 216–225.

Courneya, K. S., Jones, L. W., Rhodes, R. E., Blanchard, C. M. (2003). Effect of response scales on self-reported exercise frequency. *American Journal of Health Behavior, 27,* 613–622.

De Coverley Veale, D. M. E. (1987). Exercise dependence. *British Journal of Addiction, 82,* 735–740.

Ebbeck, E., Watkins, P. L., Concepcion, R. Y., Cardinal, B. J. & Hammermeister, J. (2009). Muscle dysmorphia symptoms and their relationship to self-concept and negative affect among college recreational exercisers. *Journal of Applied Sport Psychology, 21,* 262–275.

Fairburn, C. G. & Bohn, K. (2005). Eating disorders NOS (EDNOS): An example of troublesome "not otherwise specified" (NOS) category in DSM-IV. *Behaviour Research and Therapy, 43,* 691–701.

Fairburn, C. G., Cooper, Z. & Shafran, R. (2003). Cognitive behavior therapy for eating disorders: A transdiagnostic theory and treatment. *Behavior Research and Treatment, 41,* 509–528.

Godin, G. & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sports Science, 10,* 141–146.

Grandi, S., Clementi, C., Guidi, J., Benassi, M. & Tossani, E. (2011). Personality characteristics and psychological distress

associated with primary exercise dependence: An exploratory study. *Psychiatric Reseacrh, 189,* 270–275.

Grieve, F. G., Jackson, L., Reece, T., Marklin, L. & Delaney, A. (2008). Correlates of social physique anxiety in men. *Journal of Sport Behavior, 31,* 329–337.

Haskell, W. L., Lee, I., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., Macera, C. A., Heath, G. W., Thompson, P. D. & Bauman, A. (2007). Physical activity and public health. Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Circulation, 116,* 1081–1093.

Hausenbals, H. A. & Fallon, E. A. (2002). Relationship among body image, exercise behavior, and exercise dependence symptoms. *International Journal of Eating Disorders, 32,* 179–185.

Hausenblas, H. A. & Symons Downs, D. (2002a). Exercise dependence: A systematic review. *Psychology of Sport and Exercise, 3,* 89–123.

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

Hay, P. J. & Fairburn, C. G. (1998). The validity of the DSM-IV scheme for classifying bulimic eating disorders. *International Journal of Eating Disorders, 23,* 7–15.

Jacobs, D. R., Ainsworth, B. E., Hartman, T. J. & Leon, A. S. (1993). A simultaneous evaluation of ten commonly used physical activity questionnaires. *Medicine & Science in Sports & Exercise, 25,* 81–91.

Kjelsas, E. & Augustad, L. B. (2003). Gender differences in competitive runners and their motive for physical activity. *European Journal of Psychiatry, 17,* 157–171.

Klein D. A., Bennett A. S., Schebendach J., Foltin R. W., Devlin M. J. & Walsh, B. T. (2004). Exercise "addiction" in anorexia nervosa: model development and pilot data. *CNS Spectrums, 9,* 531–537.

Kostanski, M., Fisher, A. & Gullone, E. (2004). Current conceptualization of body image dissatisfaction: Have we got it wrong? *Journal of Child Psychology and Psychiatry, 45,* 1317–1325.

Kuennen, M.R. & Waldren, J.J. (2007). Relationships between specific personality traits, fat free mass indices, and the Muscle Dysmorphia Inventory. *Journal of Sports Behavior, 30,* 453–470.

Levine, M. P. & Smolak, L. (2006). *The prevention of eating disorders: Theory, research, and practice.* Mahwah, NJ: Lawrence Erlbaum Associates.

Masters, K. S. & Lambert, J. (1989). On gender comparison and construct validity: An examination of the Commitment to Running Scale in a sample of marathon runners. *Journal of Sport Behavior, 12,* 196–203.

Pierce, E. F., Rohaly, K. A. & Fritchley, B. (1997). Sex differences on exercise dependence for men and women in a marathon road race. *Perceptual and Motor Skills, 84,* 991–994.

Pope, H. G., Jr., Gruber, A. J., Choi, P., Olivardia, R. & Phillips, K. A. (1997). Muscle dysmorphia: An underrecognized form of body dysmorphic disorder. *Psychosomatics, 38,* 548–557.

Pope, H. G., Jr., Katz, D. L. & Hudson, J. I. (1993). Anorexia nervosa and "reverse anorexia" among 108 male bodybuilders. *Comprehensive Psychiatry, 34,* 406–409.

Pope, H. G., Jr., Phillips, K. A. & Olivardia, R. (2000). *The adonis complex: The secret crisis of male body obsession*. New York, NY: The Free Press.

Presnell, K., Bearman, S. K. & Stice, E. (2004). Risk factors for body dissatisfaction in adolescent boys and girls: A prospective study. *International Journal of Eating Disorders, 36,* 389–401.

Robert, C. A., Munroe-Chandler, K. J. & Gammage, K. L. (2009). The relationship between the drive for muscularity and muscle dysmorphia in male and female weight trainers. *The Journal of Strength and Conditioning Research, 23,* 1656–1662.

Smith, D. K., Hale, B. D. & Collins, D. (1998). Measurement of exercise dependence in bodybuilders. *Journal of Sports Medicine and Physical Activity, 38,* 66–74.

Sobel, S. V. (2004). Eating disorders. *Continuing Medical Education Resource, 118,* 69–114.

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

Szabo, A. (2000). Physical activity and psychological dysfunction. In S. Biddle, K. Fox & S. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 130–153). London: Routledge.

Thompson, J. K., Heinberg, L. J., Altabe, M. & Tantleff-Dunn, S. (1999). Exacting beauty. *Theory, assessment, and treatment of body image disturbance.* Washington, DC: American Psychological Association.

Tylka, T. L. & Subich, L. M. (2002). Exploring young women's perceptions of the effectiveness and safety of maladaptive weight control techniques. *Journal of Counseling and Development, 80,* 101–111.

USDHHS (2008). 2008 Physical activity guidelines for Americans. www.health.gov/paguidelines/guidelines/default.aspx.

Weik, M. & Hale, B. D. (2009). Contrasting gender differences on two measures of exercise dependence. *British Journal of Sports Medicine, 43,* 204–207.