Although excessive exercise has been studied by many investigators over the past two decades, consensus on its definition, diagnostic criteria, or etiology has not been reached (Johnston, Reilly, & Kremer, 2011). Researchers agree that excessive exercise encompasses both quantitative and qualitative aspects. In fact, a number of assessment tools such as the Obligatory Exercise Questionnaire (OEQ; Thompson & Pasman, 1991) and the Compulsive Exercise Test (CET; Taranis, Touyz, & Meyer, 2011) acknowledge the multidimensional nature of excessive exercise with questions targeting both its quantitative and emotional aspects.

While there may be an emerging consensus on the multidimensionality of excessive exercise, there have been several different definitions and labels assigned to this construct. Excessive exercise has been described as obligatory exercise (Pasman & Thompson, 1988), compulsive exercise (Yates, 1991), exercise dependence (Ogden, Veale, & Summers, 1997), exercise addiction (Terry, Szabo, & Griffiths, 2004), and dysfunctional exercise (Calogero & Pedrotty-Stump, 2010). Since a universal definition and underlying cause have not yet been determined, the more general term excessive exercise (termed exercise dependence by the authors) be defined as a multidimensional maladaptive pattern of exercise manifested by three or more of the following: tolerance to higher levels of exercise, withdrawal symptoms, intention effects (more exercise than was intended), loss of control, time, conflict with other activities, and continuance despite physical or psychological problems related to the exercise.

An evidence-based model developed by Meyer and colleagues (Meyer et al., 2011) suggested that the definition of such exercise should refer to (a) weight and shape concerns and (b) avoidance of negative affect and perceived negative consequences of discontinuing the exercise.

Researchers have investigated the association between excessive exercise and eating disorders to understand the nature of their relation (Johnston et al., 2011). To date, studies have demonstrated that the frequency and intensity of the exercise (i.e., the quantitative dimension) are not associated with disordered eating attitudes and behaviors (Adkins & Keel, 2005; Boyd, Abraham, & Luscombe, 2007; Lipsey, Barton,
Hulley, & Hill, 2006; Mond, Hay, Rodgers, Owen, & Beumont, 2004; Mond, Myers, Crosby, Hay, & Mitchell, 2008). On the other hand, the emotion-laden or qualitative dimension of excessive exercise (i.e., exercising to control weight/shape, feelings of compulsion, continuance despite interference with other responsibilities) is linked with increased eating pathology (Ackard, Brehm, & Steffen, 2002; Adkins & Keel, 2005; Brehm & Steffen, 1998; Davis, Brewer, & Ratusny, 1993; Matheson & Crawford-Wright, 2000; Mond et al., 2004, Mond et al., 2008; Steffen & Brehm, 1999). Thus, it is not the amount of exercise but rather its meaning within the context of the person’s life that may be related to eating disorders.

While Davis and colleagues (Davis et al., 1993) were the first to examine the relations between exercising and specific psychological variables among men and women, the majority of research that followed this seminal study has focused on the coexistence of exercising and eating– or weight-related variables among female participants only. The results of such studies that are limited to women may not be generalized to men. One study that examined associations among excessive exercise, eating disorder behaviors, and certain psychological traits in college women used cluster analysis of OEQ subscale scores to identify distinct profiles of exercisers, particularly a subgroup of excessive exercisers who demonstrated clear links among exercise beliefs and behaviors, eating disorder characteristics, and psychopathology (Ackard et al., 2002). Using the same method of typing exercisers based on clustering OEQ scores, the aims of the present study were (a) to determine if excessive exercise was related to eating disorder and psychological characteristics in college men, in a way similar to that found among women and (b) to document additional psychological characteristics of eating disorder–linked exercise in both men and women.

We surveyed participants about their attitudes and behaviors related to exercise and diet. In addition, we used measures of eating self-efficacy, eating restraint, and psychological distress (PD) and well-being. It was expected that, consistent with their generalized negative cognitive framework (De Young & Anderson, 2010; Meyer et al., 2011; Stice, Bohon, Marti, & Fischer, 2008), excessive exercisers will feel ineffectual with regard to their ability to control their eating behavior, will likely engage in substantial restraint related to eating behaviors, will be psychologically distressed and conversely low in well-being, and will exhibit disordered eating behaviors and beliefs. Such findings will reaffirm the profiles of female exercisers developed in prior research (Ackard et al., 2002) and, more importantly, will inform the development of male exercisers’ profiles based on the clustering of scores on the OEQ’s factor analytically derived subscales.

**Methods**

**Participants**

Participants were students at a large Midwestern university who volunteered in partial fulfillment of their introductory psychology course requirements. Announcements of the study and sign-up sheets were posted in the Psychology Department. The study was approved by the university’s Institutional Review Board.

Participants included 528 college students (193 males, 306 females, 29 missing data on sex) between the ages of 18 and 48 (X = 20.18 (2.45)). Over half of the participants were freshmen (51.7%), with sophomores (29.1%), juniors (13.3%), and seniors (5.9%) also participating. In regard to race and ethnicity, the majority of participants (77.4%) were White, with the remainder being Black, non-Hispanic (13.7%), Asian/Pacific Islander (6.9%), Hispanic (1.8%), and American Indian/Alaskan Native (less than 1%). Among males, the average Body Mass Index (BMI) was 23.96 ± 3.34 (range = 17.69-37.70); the average BMI for females was 22.44 ± 3.98 (range = 14.82-37.69). Females reported a higher current weight (135.77 ± 24.77 lbs.) than ideal weight (124.72 ± 15.33 lbs.), while males’ self-reported weight (171.93 ± 27.01 lbs.) and ideal weight (173.01 ± 24.01 lbs.) were similar.

**Procedure**

All questionnaires were completed in small groups of participants with trained research assistants (RAs) as facilitators over four academic quarters. The RAs obtained informed consent from each participant and then distributed packets containing the study questionnaires. Five orders of the instruments were randomly chosen and used to counterbalance order effects. Most participants completed the anonymous questionnaires in approximately 1 hr. After returning the questionnaires and optical scan answer forms, participants were given credit slips, indicating that they had completed the study in partial fulfillment of the requirements for an introductory psychology course.

**Measures**

**Participant/lifestyle characteristics.** A brief questionnaire was developed by the investigators to obtain information about participants’ age, sex, ethnicity, race, and year in school, as well as self-reported height, weight, and ideal weight. Information about the frequency of dieting and type, frequency, and amount of time spent exercising was also obtained. There are no data available on this measure’s psychometric properties as it was developed for use in the current study.

**Exercise.** The OEQ (Pasman & Thompson, 1988; Thompson & Pasman, 1991) is a 20-item questionnaire that measures attitudes and activities related to exercise. The instrument’s reliability and validity have been documented among obligatory exercisers and sedentary individuals recruited from road races, weight training facilities, and undergraduate psychology courses (Pasman & Thompson, 1988) and among runners (Coen & Ogles, 1993). Individuals report on a 4-point Likert-type scale how often they experience each
exercise-related situation. Higher scores indicate a stronger sense of obligation to exercise.

**Mental health.** The Mental Health Inventory (MHI; Veit & Ware, 1983) is a 46-item measure of mental health status that was developed for use in the Rand Medical Outcomes Studies. It is a hierarchically structured measure that has a first-order overall measure, the Mental Health Index, 2 second-order subscales measuring Psychological Well-Being (PWB) and PD, and 6 third-order constituent subscales that measure Anxiety, Depression, and Loss of Behavioral and Emotional Control (PD) and Emotional Ties, General Positive Affect, and Life Satisfaction (PWB). There has been a wide array of studies with diverse populations attesting to this instrument’s internal consistency, test-retest reliability, construct validity, and criterion-related validity (McDowell, 2006, pp. 247-253; Veit & Ware, 1983; Ware, Manning, Duan, Wells, & Newhouse, 1984).

**Eating self-efficacy.** The Eating Self-Efficacy Scale (ESES) is a 25-item questionnaire to assess perceived control over food consumption, with demonstrated internal consistency, test-retest reliability, and convergent validity among male and female undergraduate college students (Glynn & Ruderman, 1986). The Negative Affect subscale reflects perceived difficulty controlling eating when experiencing negative feelings, while the Socially Acceptable Circumstances subscale assesses difficulty controlling eating during social occasions. Individuals rate their difficulty controlling eating on a scale of 1 (no difficulty) to 7 (most difficulty) for each of 25 conditions. Higher scores are indicative of less eating self-efficacy.

**Restrained eating.** The Revised Restraint Scale (RRS; Herman & Polivy, 1980) is a 10-item self-report questionnaire that assesses the extent of and concern about dieting. High scores indicate elevated levels of dietary restraint. Internal reliability of the RRS was high and similar (.77 and .78) among both male and female college students (Klem, Klesges, Bene, & Mellon, 1990). The scale’s validity as an indicator of the intent to diet and susceptibility for overeating has been adequately documented in adult men and women (Williamson et al., 2007).

**Eating disorder characteristics.** The Eating Disorder Inventory (EDI; Garner, Olmstead, & Polivy, 1983) is a 64-item multidiimensional self-report instrument that assesses psychological and behavioral characteristics of anorexia and bulimia nervosa. Reliability estimates have been documented among male and female students in undergraduate psychology courses (Wear & Pratz, 1987), as well as content, construct, and criterion-related validity in patient and nonpatient samples (Garner, 1991; Garner et al., 1983). The EDI has eight subscales that assess specific eating disorder attitudes and behaviors. Items are presented in a 6-point format and are scored by assigning the three least pathological responses a score of 0 and the other responses 1, 2, or 3 in order of lowest to highest pathology. Higher scores reflect greater degrees of the measured characteristic.

In the analyses that follow, the first step involves factor and cluster analyses of the OEQ to identify excessive exercise patterns, separately, in male and female participants. Then types of exercisers are compared on the measures of eating disorder and psychological characteristics.

**Results**

**Factor Analysis**

The OEQ was subjected to a principal axis factor analysis with an oblique rotational solution (Direct Oblim in SPSS). Oblique rotation was used because the factors appeared to be moderately correlated with one another, even under an orthogonal rotation. This analysis produced a four-factor solution for both males and females that explained, respectively, 54.8% and 54% of the variance in the item set. Although there are slight differences between males and females in the items constituting each factor, the majority of them are similar. The Exercise Frequency/Intensity factor includes items addressing the type and frequency of exercising and the drive to exercise; the Exercise Emotionality factor’s items describe negative feelings associated with exercising or lack of exercising; the Exercise Commitment factor includes items that describe recording and scheduling of exercise sessions; the Exercise Obsession factor’s items describe preoccupation with exercising and exercising despite adversity.

Tables 1 and 2 contain the OEQ items, subdivided by their factors, for males and females, respectively, with their corresponding factor loadings and internal consistency reliabilities (Cronbach’s $\alpha$) for each factor scale. The reliabilities were acceptable for all scales except for males’ Factor 3 which was quite low (.374). For men, Factors 1 (Exercise Frequency/Intensity) and 2 (Exercise Emotionality) were moderately correlated with Factor 4 (Exercise Obsession) at .431 and .537, respectively. Factor 3 essentially was not correlated with the other factors. For women, Factor 1 (Exercise Emotionality) was slightly to moderately correlated with Factor 2 (Exercise Frequency/Intensity), Factor 3 (Exercise Obsession), and Factor 4 (Exercise Commitment). .279, .365, and .386, respectively. In addition, Factor 2 was moderately correlated (.423) with Factor 4.

**Male Typology**

Participants were then clustered with their OEQ subscale scores as the clustering variables using Hierarchical Cluster Analysis with Ward’s Method on squared Euclidian distances in SPSS. For men, a three-cluster solution provided the clearest differentiation among groups. Table 3 includes descriptive statistics for the three cluster analysis-derived groups of males on the OEQ subscales. Members of Group 1...
SAGE Open (n = 100) scored high on exercise frequency/intensity, average on exercise commitment, and low on emotionality and obsession; thus, this group was labeled “Exercisers.” Males in Group 2 (n = 60) were characterized by low scores on all four subscales and were labeled “Non-Exercisers.” In contrast, participants in Group 3 (n = 33) scored high on all four factors, particularly exercise emotionality and obsession, and therefore were assigned the name “Emotional/Obsessive (EO) Excessive Exercisers.”

Separate univariate and multivariate analyses of variance (MANOVA) and chi-square analyses were conducted to examine the effects of the three cluster groupings on the different sets of variables. Effect sizes were estimated post hoc using phi (φ) and, following Cohen (1988), interpreting values of .10 as small, .39 as medium, and .50 as large. Eta squared (η²) was used to estimate effect sizes for univariate analyses of variance, interpreting values of .01 as small, .059 as medium, and .138 as large. See Table 4 for means and standard deviations of the variables.

Table 1. Factor Loadings of OEQ Itemsa for Male Participants.

| Factor 1: Exercise Frequency/Intensity | Factor loading | Cronbach’s α |
|---------------------------------------|----------------|--------------|
| 2. I engage in one or more of the following forms of exercise: walking, jogging, running, or weightlifting. | .851 | .852 |
| 1. I engage in physical exercise on a daily basis. | .847 | |
| 3. I exercise more than three days per week. | .827 | |
| 5. I sometimes feel like I don’t want to exercise but I go ahead and push myself anyway. | .636 | |
| 20. I will engage in other forms of exercise if I am unable to engage in my usual form of exercise. | .623 | |
| 9. If I miss a planned workout, I attempt to make up for it the next day. | .546 | |
| 6. My best friend likes to exercise. | .340 | |

Factor 2: Exercise Emotionality

7. When I miss an exercise session, I feel concerned about my body possibly getting out of shape. | .750 | .751 |

12. If I feel I have overeaten, I will try to make up for it by increasing the amount I exercise. | .631 | |

4. When I don’t exercise, I feel guilty. | .602 | |

13. When I miss a scheduled exercise session, I may feel tense, irritable, or depressed. | .554 | |

11. Sometimes I feel a need to exercise twice in one day, even though I may feel a bit tired. | .515 | |

Factor 3: Exercise Commitment

16. I keep a record of my exercise performance such as how long I work out, how far, or how fast I run. | .479 | .374 |

8. If I have planned to exercise at a particular time and something unexpected comes up (like an old friend comes to visit or I have some work that needs immediate attention) I usually skip my exercise for that day. | .433 | |

10. I may miss a day of exercise for no good reason. | .344 | |

Factor 4: Exercise Obsession

18. I frequently “push myself to the limits.” | .649 | .719 |

14. Sometimes I find that my mind wanders to thoughts about exercising. | .633 | |

15. I have had daydreams about exercising. | .576 | |

17. I have experienced a feeling of euphoria or a “high” during or after an exercise session. | .544 | |

19. I have exercised even when advised against such activity (i.e., by a doctor, friend, etc.) | .526 | |

Note. OEQ = Obligatory Exercise Questionnaire.

aOriginal OEQ item numbers.
bReverse scored.

EO Excessive Exercisers were more likely to have dieted within their lifetime, χ²(2) = 5.7, ns; ethnicity, χ²(6) = 8.2, ns; height, F(2, 182) = 2.8, ns; weight, F(2, 182) = 1.8, ns; ideal weight, F(2, 182) = 2.8, ns; or BMI, F(2, 182) = 2.7, ns. However, there were significant differences for all of the other variables.

EO Excessive Exercisers were more likely to have dieted within their lifetime, χ²(2) = 25.1, p < .001, φ = .394, than the other two groups. As expected, both groups of exercisers were more likely than non-exercisers to have ever exercised, χ²(2) = 25.8, p < .001, φ = .373, and within the past year or currently, χ²(8) = 28.8, p < .001, φ = .394, than the other two groups. Participant/Lifestyle Questionnaire. Chi-square or analysis of variance, depending on the variable’s metric, was used to analyze this set of variables. There were no differences for year in school, χ²(6) = 5.7, ns; ethnicity, χ²(6) = 8.2, ns; height, F(2, 182) = 2.8, ns; weight, F(2, 182) = 1.8, ns; ideal weight, F(2, 182) = 2.8, ns; or BMI, F(2, 182) = 2.7, ns. However, there were significant differences for all of the other variables.
differed significantly with regard to the number of minutes they spent each week in exercise activities with Exercisers (Scheffé = 26.2, \( p < .01 \)) and EO Excessive Exercisers (Scheffé = 39.2, \( p < .001 \)) exceeding the time of Non-Exercisers, \( F(2, 182) = 9.5, p < .001, \eta^2 = .095 \).

**MHI.** The MANOVA revealed a significant effect for PD and PWB on the MHI, \( F(4, 342) = 7.0, p < .001 \). Univariate ANOVAs showed significant differences on both PD, \( F(2, 171) = 9.9, p < .001, \eta^2 = .103 \), and PWB, \( F(2, 171) = 10.5, p < .001, \eta^2 = .095 \). Non-Exercisers were more distressed and had lower well-being than Exercisers (PD: Scheffé post hoc mean difference = −11.5, \( p < .005 \); PWB: Scheffé = 8.3, \( p < .001 \)). EO Excessive Exercisers (PD: Scheffé = 12.1, \( p < .01 \); PWB: Scheffé = 4.0, ns) had more distress than Exercisers but did not differ from them with regard to well-being. No other comparisons reached significance.

**ESES.** In regard to the Eating Self-Efficacy subscales (i.e., Socially Acceptable Circumstances and Negative Affect), there were no significant multivariate differences among the clusters, \( F(4, 358) = 1.13, ns \).

**RRS.** An ANOVA, \( F(2, 181) = 11.2, p < .001, \eta^2 = .11 \), and subsequent post hoc tests showed that EO Excessive Exercisers scored significantly higher on the RRS than the other two groups (Exercisers: Scheffé = 5.0, \( p < .001 \); Non-Exercisers: Scheffé = 5.0, \( p < .001 \)) which did not differ from one another.

**EDI.** The MANOVA showed a significant multivariate effect for the EDI, \( F(16, 348) = 3.3, p < .001 \), with subsequent univariate effects for the subscales of Drive for Thinness, \( F(2, 180) = 14.3, p < .001, \eta^2 = .137 \); Bulimia, \( F(2, 180) = 3.3, p < .05, \eta^2 = .035 \); and Interoceptive Awareness, \( F(2, 180) = 8.4, p < .001, \eta^2 = .085 \). Post hoc tests
Table 3. Means, Standard Deviations, and Group Size (N) of Three Cluster Analysis-Derived Groups of Males on Obligatory Exercise Questionnaire Subscales.

| Group (N)          | Exercise Frequency/Intensity | Exercise Emotionality | Exercise Commitment | Exercise Obsession |
|--------------------|-----------------------------|-----------------------|---------------------|-------------------|
| 1. Exercisers (100)| 0.451 (0.539)               | −0.334 (0.596)        | 0.039 (0.701)       | −0.067 (0.587)    |
| 2. Non-Exercisers (60)| −1.152 (0.440)            | −0.229 (0.699)        | −0.153 (0.754)      | −0.614 (0.571)    |
| 3. Emotional/Obsessive Excessive Exercisers (33) | 0.727 (0.701) | 1.426 (0.547) | 0.159 (0.690) | 1.319 (0.679) |

Table 4. Descriptive Statistics (Means and Standard Deviations) of Three Cluster Analysis-Derived Groups of Males on Selected Psychological Measures.

| Scale/Subscalea | 1. Exercisers          | 2. Non-Exercisers      | 3. Emotional/Obsessive Excessive Exercisers |
|-----------------|------------------------|------------------------|--------------------------------------------|
| MHI-Psychological Distress | 56.44 (15.13)           | 67.94 (20.96)           | 68.55 (16.74)                              |
| MHI-Psychological Well-Being  | 56.51 (9.40)            | 48.22 (12.73)           | 52.55 (9.64)                               |
| ESES-Negative Affect        | 26.73 (13.26)           | 27.81 (16.88)           | 33.00 (14.58)                              |
| ESES-Socially Acceptable Circumstances | 25.73 (12.01) | 25.64 (13.88) | 27.83 (12.29) |
| Revised Restraint Scale     | 8.95 (4.77)             | 10.0 (6.10)             | 13.97 (6.04)                               |
| EDI-Drive for Thinness      | 2.96 (1.79)             | 4.32 (3.26)             | 5.81 (3.77)                                |
| EDI-Bulimia                | 0.89 (1.81)             | 1.64 (3.14)             | 2.03 (2.75)                                |
| EDI-Body Dissatisfaction    | 7.77 (4.03)             | 7.75 (3.95)             | 7.13 (3.84)                                |
| EDI-Ineffectiveness        | 7.99 (2.85)             | 8.52 (3.28)             | 7.69 (3.37)                                |
| EDI-Perfectionism          | 7.82 (4.12)             | 6.66 (4.32)             | 8.16 (4.24)                                |
| EDI-Interpersonal Distrust  | 7.98 (3.44)             | 7.39 (3.18)             | 7.44 (3.72)                                |
| EDI-Interceptive Awareness  | 2.66 (2.52)             | 5.00 (4.73)             | 4.69 (4.49)                                |
| EDI-Maturity Fears         | 4.84 (2.82)             | 5.84 (3.76)             | 6.19 (3.69)                                |

aMHI = Mental Health Inventory; ESES = Eating Self-efficacy Scale; EDI = Eating Disorder Inventory.

Table 5. Means, Standard Deviations, and Group Size (N) of Five Cluster Analysis-Derived Groups of Females on Obligatory Exercise Questionnaire Subscales.

| Group (N)                             | Exercise Frequency/Intensity | Exercise Emotionality | Exercise Commitment | Exercise Obsession |
|---------------------------------------|-----------------------------|-----------------------|---------------------|-------------------|
| 1. Emotional/Obsessive Non-Exercisers (44) | −0.599 (0.466)             | 0.620 (0.808)         | −0.216 (0.592)      | 0.896 (0.617)     |
| 2. Non-Exercisers (75)                | −0.997 (0.398)             | −0.904 (0.357)        | −0.734 (0.442)      | −0.543 (0.386)    |
| 3. Average Exercisers (124)           | 0.328 (0.626)             | −0.153 (0.590)        | −0.045 (0.521)      | −0.297 (0.577)    |
| 4. High Intensity Exercisers (47)     | 0.975 (0.768)             | 0.734 (0.671)         | 1.077 (0.549)       | 0.131 (0.616)     |
| 5. Emotional/Obsessive Excessive Exercisers (16) | 0.916 (0.593) | 1.563 (0.848) | 1.219 (0.479) | 1.998 (0.660) |

indicated statistically significant differences on the Drive for Thinness subscale with Exercisers scoring lower than Non-Exercisers (Scheffé = −1.4, p < .05) and EO Excessive Exercisers (Scheffé = −2.9, p < .001). Non-Exercisers were also significantly lower than EO Excessive Exercisers (Scheffé = −1.5, p < .05). On the Interoceptive Awareness subscale, Exercisers scored significantly lower than both of the other two groups (Non-Exercisers: Scheffé = −2.3, p < .05; EO Excessive Exercisers: Scheffé = −2.0, p < .05) which, in turn, did not differ from one another. There were no post hoc significant differences among the groups on the Bulimia subscale.

Female Typology

For women, a five-cluster solution provided the clearest differentiation among groups. Table 5 includes descriptive statistics for the five cluster analysis-derived groups of females on the OEQ subscales. Members of Group 1 (n = 44) scored high on emotionality and obsession and low on exercise frequency/intensity and exercise commitment; thus, this group was labeled “EO Non-Exercisers.” Women in Group 2 (n = 75) scored the lowest on all four factors and were labeled “Non-Exercisers.” Group 3 participants (n = 124) were characterized by slightly elevated scores on frequency/intensity...
and low to average scores on obsession, commitment, and emotionality; they were labeled “Average Exercisers.” Participants in Group 4 (n = 47) scored quite high on commitment, frequency/intensity, and emotionality but average on obsession; they were labeled “High Intensity Exercisers.” Group 5 members (n = 16) scored the highest of all groups on emotionality, obsession, and commitment and second highest on exercise frequency/intensity and were labeled “EO Excessive Exercisers.”

Separate univariate and MANOVA examined the effects of cluster membership on the different sets of variables. See Table 6 for means and standard deviations of the variables.

| Scale/subscale | 1. Emotional Obsessive Exercisers | 2. Non-Exercisers | 3. Average Exercisers | 4. High Intensity Exercisers | 5. Emotional/Obsessive Excessive Exercisers |
|---------------|----------------------------------|-------------------|-----------------------|-----------------------------|-------------------------------------------|
| MHI-Psychological Distress | 83.06 (18.91) | 66.69 (20.85) | 64.04 (19.00) | 62.78 (14.50) | 63.75 (14.34) |
| MHI-Psychological Well-Being | 44.19 (12.01) | 49.97 (13.39) | 53.69 (11.35) | 54.15 (10.27) | 55.13 (15.53) |
| ESES-Negative Affect | 50.85 (18.38) | 33.04 (13.79) | 35.85 (16.53) | 34.78 (13.47) | 43.50 (20.54) |
| ESES-Socially Acceptable Circumstances | 40.43 (11.12) | 29.04 (13.79) | 32.93 (11.91) | 33.09 (12.66) | 40.94 (16.18) |
| Revised Restraint Scale | 17.07 (4.98) | 8.72 (5.85) | 12.80 (5.43) | 15.33 (5.15) | 19.06 (5.26) |
| EDI-Drive for Thinness | 11.59 (4.93) | 4.68 (3.41) | 5.62 (4.55) | 7.76 (4.68) | 12.38 (4.92) |
| EDI-Bulimia | 2.84 (2.76) | 1.12 (2.17) | 1.09 (2.34) | 0.98 (1.36) | 2.44 (2.99) |
| EDI-Body Dissatisfaction | 8.48 (3.50) | 7.15 (3.64) | 7.00 (3.32) | 7.27 (4.01) | 8.81 (2.43) |
| EDI-Ineffectiveness | 6.52 (3.30) | 7.39 (3.64) | 7.08 (2.94) | 7.58 (2.13) | 7.31 (3.44) |
| EDI-Perfectionism | 7.00 (4.40) | 6.47 (4.06) | 6.55 (3.99) | 9.41 (4.00) | 9.53 (4.37) |
| EDI-Interpersonal Distrust | 6.82 (2.81) | 7.40 (3.22) | 8.37 (3.20) | 8.11 (3.56) | 8.63 (2.39) |
| EDI-Interoceptive Awareness | 6.93 (4.79) | 4.05 (3.88) | 3.43 (3.47) | 3.96 (3.64) | 6.00 (3.25) |
| EDI-Maturity Fears | 4.82 (3.19) | 5.61 (3.19) | 4.09 (3.09) | 4.67 (2.91) | 4.88 (3.15) |

Table 6. Descriptive Statistics (Means and Standard Deviations) of Five Cluster Analysis-Derived Groups of Females on Selected Psychological Measures.

* MHI = Mental Health Inventory; ESES = Eating Self-efficacy Scale; EDI = Eating Disorder Inventory.

MHI. The MANOVA revealed significant effects for the MHI subscales, F(8, 558) = 4.5, p < .001, with follow-up ANOVAs having significant effects on PD, F(4, 279) = 7.8, p < .001, η2 = .1, and PWB, F(4, 279) = 5.6, p < .001, η2 = .074. For the PD subscale, EO Non-Exercisers scored significantly higher than all other groups (Scheffé range = 16.2 to 20.1, p < range = .05 to .001). No other group scored significantly different from any other group. For the PWB subscale, EO Non-Exercisers scored significantly lower than the other groups (Scheffé range = −11.3 to −9.4, p < range = .05 to .01) except for Non-Exercisers.

ESSES. The MANOVA, F(8, 572) = 5.0, p < .001, and follow-up ANOVAs found significant effects for both subscales, Negative Affect, F(4, 286) = 8.1, p < .001, η2 = .101, and Socially Acceptable Circumstances, F(4, 286) = 6.5, p < .001, η2 = .084. On the Negative Affect subscale, EO Excessive Exercisers scored significantly higher than all other groups except for EO Non-Exercisers (Scheffé range = 15.5 to 18.1, p < range = .005 to .001). On the Socially Acceptable Circumstances subscale, EO Non-Exercisers scored significantly higher than all other groups except for EO Excessive Exercisers (Scheffé range = 16.2 to 20.1, p < range = .05 to .001).
scored significantly higher than Non-Exercisers (Scheffé = 11.3, $p < .001$) and Average Exercisers (Scheffé = 7.3, $p < .05$) but not higher than the other groups. EO Excessive Exercisers only scored significantly higher than the Non-Exercisers (Scheffé = 12.0, $p < .05$).

**RRS.** There was a significant univariate effect found for the RRS, $F(4, 295) = 24.6$, $p < .001$, $\eta^2 = .25$. EO Excessive Exercisers scored significantly higher than Non-Exercisers (Scheffé = 10.3, $p < .001$) and Average Exercisers (Scheffé = 6.3, $p < .001$) but not the EO Non-Exercisers or the High Intensity Exercisers.

**EDI.** A significant multivariate effect was found for the EDI, $F(32, 1148) = 4.6$, $p < .001$, with subsequent significant univariate effects found on the subscales of Drive for Thinness, $F(4, 291) = 27.6$, $p < .001$, $\eta^2 = .275$; Bulimia, $F(4, 291) = 5.8$, $p < .001$, $\eta^2 = .073$; Perfectionism, $F(4, 291) = 5.7$, $p < .001$, $\eta^2 = .072$; Interpersonal Distrust, $F(4, 291) = 3.0$, $p < .05$, $\eta^2 = .039$; and Interoceptive Awareness, $F(4, 291) = 6.7$, $p < .001$, $\eta^2 = .084$. On the Drive for Thinness subscale, EO Non-Exercisers and EO Excessive Exercisers scored similarly and significantly higher than all other groups (Scheffé range = 4.1 to 8.0, $p < .001$). High Intensity Exercisers scored significantly higher than Non-Exercisers (Scheffé = 3.1, $p < .01$) but not Average Exercisers. On the Bulimia and the Interceptive Awareness subscales, EO Non-Exercisers scored significantly higher than Non-Exercisers (Bulimia: Scheffé = 1.7, $p < .01$; Interoceptive Awareness: Scheffé = 2.7, $p < .05$), Average Exercisers (Bulimia: Scheffé = 1.7, $p < .01$; Interoceptive Awareness: Scheffé = 3.3, $p < .01$), and High Intensity Exercisers (Bulimia: Scheffé = 1.8, $p < .01$; Interoceptive Awareness: Scheffé = 2.8, $p < .05$) but not EO Excessive Exercisers. On the Perfectionism subscale, High Intensity Exercisers scored significantly higher than Non-Exercisers (Scheffé = 2.9, $p < .01$) and Average Exercisers (Scheffé = 2.8, $p < .01$). With regard to Interpersonal Distrust, no individual group was significantly different from any other.

**Discussion**

The extent and nature of excessive exercise and its links with eating disorders among either men or women are unclear and still evolving. The absence of an operational definition of excessive exercise has led to the use of various instruments that measure sundry constructs; therefore, study results are often contradictory, being dependent on the measurement tool and the researcher’s conceptualization of excessive exercise. Defining excessive exercise by the amount of time engaged in an exercise activity alone ignores its multifaceted nature (Adkins & Keel, 2005; Meyer & Taranis, 2011).

The results of this study confirm past findings that excessive exercise is a multidimensional concept (Ackard et al., 2002; Steffen & Brehm, 1999). As previously demonstrated, the OEQ has subscales that reveal multiple factors associated with excessive exercise. In the current study, four factors that were nearly identical for men and women were identified: Exercise Frequency/Intensity, Exercise Emotionality, Exercise Commitment, and Exercise Obsession. Similar to prior research, some factors (i.e., Exercise Emotionality and Exercise Obsession) describe negative consequences of exercising or not being able to exercise (Ackard et al., 2002; Boyd et al., 2007; Mond et al., 2008). Those who score high on these factors feel concerned, guilty, and irritated when they miss an exercise session and are driven to exercise in spite of injury or fatigue.

The first aim of this study was to determine if excessive exercise was related to eating disorder and psychological characteristics in men, in a way similar to that found among women. A review by Ricciardelli and McCabe (2004) concurred that several risk factors (e.g., exercising for weight control and appearance) associated with disordered eating among adolescent boys are similar to those found in girls. Although research indicates that the biological, psychological, and sociocultural risk factors related to the development of disordered eating are similar among adolescent males and females (Keel, Klump, Leon, & Fulkerson, 1998), such comparison studies are lacking in the area of excessive exercise. To our knowledge, the present study is the first to develop profiles of male exercisers based on the clustering of scores on OEQ subscales and to examine the profiles of male exercisers simultaneously with those of female exercisers.

Based on a factor-informed cluster analysis of male participants, three subgroups were identified with distinctive profiles related to exercise-related attitudes and behaviors. Although almost 70% of the males (i.e., those in the Exercisers and EO Excessive Exercisers groups) were categorized as exercisers by their Exercise Frequency/Intensity scores, only the EO Excessive Exercisers displayed a propensity toward eating restraint and a drive for thinness, essential characteristics of eating disorders. This analysis continues to substantiate the premise that excessive exercise is multidimensional, even for men, and that there appears to be aspects of exercise, namely, exercise emotionality and obsession, that are linked to PD and eating disorders. On the other hand, exercise appears to relieve or buffer stress and promote a sense of well-being for some persons, as shown by the Exercisers’ well-adjusted scores on the mental health measures (i.e., lowest scores on distress and highest scores on well-being).

The typology of the female exerciser differs from that of the male in several ways. Rather than three distinct groups, the cluster analysis identified five groups of females based on OEQ factor scores. These groups are similar to the six groups identified in previous research with female college students (Ackard et al., 2002). Both studies revealed distinct groups of maladjusted exercisers and non-exercisers who demonstrated specific exercise beliefs and behaviors, eating-disordered characteristics, and psychopathology, as well as
groups of exercisers and non-exercisers who were well-adjusted in terms of psychological attributes.

In the present study, two groups (i.e., EO Non-Exercisers and EO Excessive Exercisers) scored high on the Exercise Emotionality and Exercise Obsession factors and also scored significantly higher on eating disorder measures, such as drive for thinness and both subscales of the ESES, indicating perceived difficulty controlling eating during emotionally negative and social occasions. Again, these findings reaffirm prior work that demonstrated the significant link between exercise-related cognitions and emotions and eating-disordered traits, independent of exercise frequency (Ackard et al., 2002; Steffen & Brehm, 1999). Curiously, there were no substantive nor statistically significant differences between these two groups on any measures except for the MHI subscales of PD and Well-Being with the EO Non-Exercisers faring significantly worse than the EO Excessive Exercisers. These results lend some support to the notion that excessive exercise may serve as a strategy to regulate affect for people who have eating disorders (De Young & Anderson, 2010; Meyer et al., 2011).

The second aim of this study was to identify additional psychological attributes associated with eating disorder-linked excessive exercise. Our findings related to this aim are less clear cut. While both male and female EO Excessive Exercisers scored highest or nearly highest on most eating disorder characteristics, particularly eating restraint and drive for thinness, male and female EO Excessive Exercisers were not as differentially distressed on the MHI subscales. The EO Excessive Exerciser males were similar to the Non-exercisers in both well-being and distress but they appeared to be more psychologically distressed than the Exercisers. On the other hand, the EO Excessive Exerciser females scored among the lowest on distress and highest on well-being when compared with their counterparts. As noted earlier, these findings suggest some psychologically palliative effect of exercise.

Alternative factors that may contribute to the association between excessive exercise and eating-disordered attitudes and behaviors have been addressed by several researchers. For example, diverse motives for exercise have been shown to influence exercise and eating-disordered characteristics differentially. Adkins and Keel (2005) found that health and fitness motives were linked with less eating-disordered traits, but a greater compulsion to exercise than other reasons for exercising, such as appearance and weight management. Mond and colleagues demonstrated that exercising for weight or shape and extreme guilt after missing exercise were strongly associated with eating disorder psychopathology in both clinical and nonclinical samples (Mond & Calogero, 2009; Mond et al., 2004; Mond et al., 2008).

Although motivation for exercise was not assessed in the present study, it is possible that participants who were exercising for intrinsic reasons did not display the maladjusted psychosocial characteristics that were evident in exercisers who were motivated by external appearance-related factors. Study results showed that both male and female EO Excessive Exercisers were more likely to have dieted within their lifetime and within the past year than other exercisers, and thus may have been driven to exercise by extrinsic motivators such as weight management. This might explain the existence of disparate groups of exercisers (i.e., those with well-adjusted and those with maladjusted psychological attributes) among both male and female participants.

In the current study, the presence of an EO Non-Exerciser group among females, but not males, may be related to greater concern about weight and appearance and the high prevalence of body dissatisfaction among female undergraduate students (LePage, Crowther, Harrington, & Engler, 2008; Tiggemann & Williamson, 2000). The majority of EO Non-Exercisers reported dieting now and in the past. Perhaps their weight-related concerns, accompanied by guilt about not engaging in exercise, are linked with their increased psychopathology, as previously demonstrated in excessive exercisers (Mond & Calogero, 2009).

The regulation of negative affect is another common motive for exercising, particularly among females. A recent study showed that those who undertake exercise to improve negative emotional states tend to exhibit an “obligatory” compulsion to exercise, eating-disordered behaviors and concerns, and lower self-esteem (De Young & Anderson, 2010). It is important to note that the quality, not the quantity, of exercise differed between those who exercised to alleviate negative affect and those who did not, reaffirming the multidimensionality of excessive exercise. These study results suggested that exercising for mood regulation is potentially harmful and may be a “red flag” for associated psychopathology. On the other hand, negative affect is significantly lessened from pre- to post-exercise (De Young & Anderson, 2010; LePage & Crowther, 2010). Thus, for some persons, exercise may be an effective method of coping with negative emotional states. Again, the motivation to exercise (i.e., regulation of negative affect) may have contributed to the present study’s discovery of groups of exercisers that are dissimilar in terms of psychological health.

In general, outcome-oriented motives for exercise have a negative impact on psychological health. However, Calogero and Pedrotty-Stump have demonstrated that “mindless” unhealthy exercise that focuses on outcomes rather than process may be reduced by practicing new patterns of exercise and modifying the motivators and contexts of mindless exercise (Calogero & Pedrotty, 2004, 2007; Calogero & Pedrotty-Stump, 2010). Importantly, the adoption of process-focused exercise diminishes the “obligatory” emotional element of exercise (Calogero & Pedrotty, 2004). Programs aimed at the prevention or treatment of eating disorders may benefit from the inclusion of mindful exercise (i.e., positive mindset toward exercise) that is associated with improved psychopathology (Calogero & Pedrotty-Stump, 2010).
This study has several limitations to its design and the external validity of its findings. A chief limitation is its reliance upon self-report and any unanticipated response biases that may consequently ensue. However, the consistency of our results with past studies adds a degree of credibility to our finding of the links between certain types of emotion-laden excessive exercise and eating disorder beliefs and behaviors. The generalizability of our findings is clearly limited to the population of college students and may not apply to those persons of other demographics. Replication of our methods of typing exercisers using dissimilar populations would be beneficial.

Conclusions

Excessive exercise is a multifaceted concept that cannot be defined solely by the frequency of the activity; it must also consider the exerciser’s emotions and cognitions about the exercise. Consistent with previous research, those frequent exercisers who are emotional and obsessive about their exercise routines are likely to display eating disorder behaviors such as drive for thinness, eating restraint, and some other psychological maladjustment. While males who fit this profile of the excessive exerciser (i.e., those who score high on the Emotional and Obsession factors) showed increased PD, it appears that excessive exercise may act as a coping mechanism for females with a similar profile, thereby lessening their PD and enhancing well-being. With our societal emphasis on physical fitness, exercise itself may become psychologically rewarding and socially reinforcing, perpetuating its intensity and frequency.

This study provides evidence for the existence of discrete types of exercisers (both male and female) who are represented by clusters of psychosocial characteristics. Future research is needed to confirm the typologies of male and female exercisers developed in this study. Longitudinal studies would provide important information related to the developmental sequencing of excessive exercise and eating disorders and the directionality of their relationship. In the meantime, clinicians should be aware of the link between excessive exercise and eating disorders to screen better for the co-occurrence of these conditions. They should further assess the emotionality and obsession toward exercising and interruption of exercise routines, as well as eating-related attitudes and behaviors, of those patients who exercise frequently (Thome & Espelage, 2007). While exercise may buffer the PD caused by disordered cognitions related to exercise and eating, attention to potential co-existing psychopathologies is essential.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

Ackard, D., Brehm, B. J., & Steffen, J. J. (2002). Exercise and eating disorders in college-aged women: Profiling excessive exercisers. Eating Disorders, 10, 31-47.

Adkins, E. C., & Keel, P. K. (2005). Does “excessive” or “compulsive” best describe exercise as a symptom of bulimia nervosa? International Journal of Eating Disorders, 38, 24-29.

Boyd, C., Abraham, S., & Luscombe, G. (2007). Exercise behaviors and feelings in eating disorder and non-eating disorder groups. European Eating Disorders Review, 15, 112-118.

Brehm, B. J., & Steffen, J. J. (1998). Relation between obligatory exercise and eating disorders. American Journal of Health Behavior, 22, 108-119.

Calogero, R. M., & Pedrotty, K. N. (2004). The practice and process of healthy exercise: An investigation of the treatment of exercise abuse in women with eating disorders. Eating Disorders, 12, 273-291.

Calogero, R. M., & Pedrotty, K. N. (2007). Daily practices for mindful exercise. In L. L’Abate, D. Embry, & M. Baggett (Eds.), Handbook of low-cost preventive interventions for physical and mental health: Theory, research, and practice (pp. 141-160). New York, NY: Springer-Verlag.

Calogero, R. M., & Pedrotty-Stump, K. N. (2010). Incorporating exercise into the treatment and recovery of eating disorders: Cultivating a mindful approach. In M. Maine, B. H. McGilley, & D. W. Bunnell (Eds.), Treatment of eating disorders: Bridging the research-practice gap (pp. 425-441). New York, NY: Elsevier.

Coen, S. P., & Ogles, B. M. (1993). Psychological characteristics of the obligatory runner: A critical examination of the anorexia analogue hypothesis. Journal of Sport and Exercise Psychology, 15, 338-354.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Davis, C., Brewer, H., & Ratusny, D. (1993). Behavioral frequency and psychological commitment: Necessary concepts in the study of excessive exercising. Journal of Behavioral Medicine, 16, 611-628.

De Young, K. P., & Anderson, D. A. (2010). Prevalence and correlates of exercise motivated by negative affect. International Journal of Eating Disorders, 43, 50-58.

Garner, D. M. (1991). Eating Disorder Inventory 2. Odessa, FL: Psychological Assessment Resources.

Garner, D. M., Olmstead, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory of anorexia nervosa and bulimia. International Journal of Eating Disorders, 2, 15-34.

Glynn, S. M., & Ruderman, A. J. (1986). The development and validation of an Eating Self-Efficacy Scale. Cognitive Therapy and Research, 10, 403-420.

Hausenblas, H. A., & Downs, D. S. (2002). How much is too much? The development and validation of the Exercise Dependence Scale. Psychology and Health, 17, 387-404.

Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. Stunkard (Ed.), Obesity (pp. 208-225). Philadelphia, PA: Saunders.
Johnston, O., Reilly, J., & Kremer, J. (2011). Excessive exercise: From quantitative categorization to a qualitative continuum approach. *European Eating Disorders Review, 19*, 237-248.

Keel, P. K., Klump, K. L., Leon, G. R., & Fulkerson, J. A. (1998). Disordered eating in adolescent males from a school-based sample. *International Journal of Eating Disorders, 23*, 125-132.

Klem, M. L., Klesges, R. C., Bene, C. R., & Mellon, M. W. (1990). A psychometric study of restraint: The impact of race, gender, weight and marital status. *Addictive Behaviors, 15*, 147-152.

LePage, M. L., & Crowther, J. H. (2010). The effects of exercise on body satisfaction and affect. *Body Image, 7*, 124-130.

LePage, M. L., Crowther, J. H., Harrington, E. F., & Engler, P. (2008). Psychological correlates of fasting and vigorous exercise as compensatory strategies in undergraduate women. *Eating Behaviors, 9*, 423-429.

Lipsey, Z., Barton, S. B., Hulley, A., & Hill, A. J. (2006). Beliefs about exercise, eating and appearance in female exercisers with and without eating disorder features. *Psychology of Sport and Exercise, 7*, 425-436.

Matheson, H., & Crawford-Wright, A. (2000). An examination of eating disorder profiles in student obligatory and non-obligatory exercisers. *Journal of Sport Behavior, 23*, 42-50.

McDowell, I. (2006). Measuring health: A guide to rating scales and questionnaires (3rd ed.). New York, NY: Oxford University Press.

Meyer, C., & Taranis, L. (2011). Exercise in the eating disorders: Terms and definitions. *European Eating Disorders Review, 19*, 169-173.

Meyer, C., Taranis, L., Goodwin, H., & Haycraft, E. (2011). Compulsive exercise and eating disorders. *European Eating Disorders Review, 19*, 174-189.

Mond, J. M., & Calogero, R. M. (2009). Excessive exercise in eating disorder patients and in healthy women. *Australian and New Zealand Journal of Psychiatry, 43*, 227-234.

Mond, J. M., Hay, P. J., Rodgers, B., Owen, C., & Beumont, P. J. (2004). Relationships between exercise behavior and quality of life in a community sample of women: When is exercise excessive? *European Eating Disorders Review, 12*, 265-272.

Mond, J. M., Myers, T. C., Crosby, R., Hay, P., & Mitchell, J. (2008). Excessive exercise and eating-disordered behaviour in young adult women: Further evidence from a primary care sample. *European Eating Disorders Review, 16*, 215-221.

Ogden, J., Veale, D., & Summers, Z. (1997). The development and validation of the Exercise Dependence Questionnaire. *Addiction Research & Theory, 5*, 343-355.

Pasman, L., & Thompson, J. K. (1988). Body image and eating disturbance in obligatory runners, obligatory weightlifters, and sedentary individuals. *International Journal of Eating Disorders, 7*, 759-769.

Ricciardelli, L. A., & McCabe, M. P. (2004). A biopsychosocial model of disordered eating and the pursuit of masculinity in adolescent boys. *Psychological Bulletin, 130*, 179-205.

Steffen, J. J., & Brehm, B. J. (1999). The dimensions of obligatory exercise. *Eating Disorders, 7*, 219-226.

Stice, E., Bohon, C., Marti, C. N., & Fischer, K. (2008). Subtyping women with bulimia nervosa along dietary and negative affect dimensions: Further evidence of reliability and validity. *Journal of Consulting and Clinical Psychology, 76*, 1022-1033.

Taranis, L., Touyz, S., & Meyer, C. (2011). Disordered eating and exercise: Development and preliminary validation of the Compulsive Exercise Test (CET). *European Eating Disorders Review, 19*, 256-268.

Terry, A., Szabo, A., & Griffiths, M. (2004). The exercise addiction inventory: A new brief screening tool. *Addiction Research & Theory, 12*, 489-499.

Thome, J. L., & Espelage, D. L. (2007). Obligatory exercise and eating pathology in college females: Replication and development of a structural model. *Eating Behaviors, 8*, 334-349.

Thompson, J. K., & Pasman, L. (1991). The Obligatory Exercise Questionnaire. *Behavior Therapist, 14*, 137.

Tiggesmann, M., & Williamson, S. (2000). The effect of exercise on body dissatisfaction and self-esteem as a function of gender and age. *Sex Roles, 43*, 119-127.

Veit, C. T., & Ware, J. E. (1983). The structure of psychological distress and well-being in a general population. *Journal of Consulting and Clinical Psychology, 51*, 730-742.

Ware, J. E., Manning, W. G., Duan, N., Wells, K. B., & Newhouse, J. P. (1984). Health status and the use of outpatient mental health services. *American Psychologist, 39*, 1090-1100.

Wear, R. W., & Pratz, O. (1987). Test-retest reliability for the Eating Disorder Inventory. *International Journal of Eating Disorders, 6*, 767-769.

Williamson, D. A., Martin, C. K., York-Crowe, E., Anton, S. D., Redman, L. M., Han, H., & Ravussin, E. (2007). Measurement of dietary restraint: Validity tests of four questionnaires. *Appetite, 48*, 183-192.

Yates, A. (1991). *Compulsive exercise and the eating disorders*. New York, NY: Brunner/Mazel.

**Author Biographies**

**Bonnie J. Brehm** is a professor, nutritionist, and researcher in the College of Nursing, University of Cincinnati. Over the past two decades, her research has focused on the treatment of obesity through diet modification, as well as the link between eating disorders and excessive exercise.

**John J. Steffen** was on the psychology faculty of the University of Hawaii. His primary research interests are focused on recovery for people who have severe and persistent mental illnesses and the primary care needs of those who have serious mental illnesses. He is now retired and living in Chicago, IL.