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An Exploration of the Aspects of Physical Activity and Exercise Motives That Confer Risk Versus Protection from Disordered Eating Outcomes

by

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Thesis

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Abstract

A long-standing health initiative has been the recommendation for individuals to engage in regular physical activity because of its numerous physical and mental health benefits. However, engaging in "excessive exercise" is a compensatory behavior found in eating disorders. The present study sought to better understand exercise as both a health- and risk-behavior. Undergraduates (N = 1010) completed an online survey assessing disordered eating and exercise behavior. Results revealed that among individuals who engaged in a low level of physical activity, exercising for socializing reasons conferred risk for disordered eating, whereas higher socializing exercise motives were associated with lower disordered eating behavior. Findings suggest that it may be particularly useful to know how often individuals engage in exercise when they have high socializing motives. Future research should examine the Exercise Benefits/Barriers Scale (EBBS) to investigate individuals' simultaneous reasons for engaging in exercise and barriers to participating in exercise.

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An Exploration of the Aspects of Physical Activity and Exercise Motives That Confer Risk Versus Protection from Disordered Eating Outcomes

Positive mental health outcomes associated with exercise are well-established. The benefits of exercise include reduced depression (Mead et al., 2009; Rimer et al., 2012) and stress (Tsatsoulis & Fountoulakis, 2006), as well as enhanced mood (Peluso & Guerra de Andrade, 2005). Exercise has also been shown to improve cardiovascular health, lower blood pressure (Stewart, 2002), and prevent weight regain in individuals who have achieved long-term weight loss (Klem, Wing, McGuire, Seagle, & Hill, 1997; Wing & Phelan, 2005).

While numerous health benefits have been linked to exercise, it is also associated with some negative consequences. For example, lower body satisfaction is associated with higher levels of exercise (Peñas-Lledó, Vaz Leal, & Waller, 2002; Tiggemann & Williamson, 2000). Certainly, exercise is a prominent compensatory behavior in some eating disorders (Dalle, Calugi, & Marchesini, 2008; Peñas-Lledó et al., 2002). In addition, a history of excessive exercise behavior is linked with a chronic anorexia nervosa course outcome and an earlier relapse period following hospital discharge (Strober, Freeman, & Morrell, 1997).

Therefore, the extant literature supports the firm understanding that exercise is both a health promoting- and risk-behavior, depending upon its context. Unfortunately, this leaves clinicians without guidelines on how to best utilize the health-promoting components of exercise for patients and mitigate potential risk factors for future eating disorders. Recent findings suggest that exercise motives, or the reasons for participating in physical activity, may elucidate the protective and risk factors of exercise as related to disordered eating.

The current study explored the relationship between exercise motives, exercise behavior, and disordered eating. There were two central purposes: a) to explore the extent to which certain exercise motives and exercise behaviors are protective factors and predict lower levels of disordered eating, and b) to determine which exercise motives and exercise behaviors are risk factors that predict higher levels of disordered eating.

Literature Review

Exercise Health Outcomes

Exercise has been shown to result in several positive psychological and physiological benefits, including the reduction of anxiety (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006) and the enhancement of body esteem (Martin & Lichtenberger, 2002; Spence, McGannon, & Poon, 2005). Exercise has also been shown to improve cholesterol (Brown, Mishra, Lee & Bauman, 2000) and help individuals manage their weight and prevent obesity-related conditions (Gillison, Standage & Skevington, 2006).

Although exercise is recommended for a healthy lifestyle, exercise is also associated with eating disorders. Excessive exercise is common among individuals with eating disorders. In a sample of 127 women, approximately 50% (n = 63) reported excessive exercise with a diagnosis of anorexia nervosa (AN), 22% (n = 28) endorsed excessive exercise with a diagnosis of bulimia nervosa (BN), and the remaining 28% (n = 26) did not meet criteria for excessive exercise (Davis et al., 1997). “Excessive exercise” was defined as exercising for more than one hour per day for at least six days per week.

The research clearly supports that exercising for weight control reasons has harmful associations for individuals with BN, including increased levels of psychopathology, poor treatment adherence, and longer BN treatment course (Löwe et al., 2008). However, exercise may be beneficial to some extent for individuals with binge

eating disorder (BED). Because patients with BED are significantly more likely to be overweight and obese, in comparison to individuals with AN and BN (American Psychiatric Association, 2013), exercise can serve as a component of treatment by reducing body mass index (BMI; Pendleton, Goodrick, Poston, Reeves, & Foreyt, 2002). This can be particularly helpful by contributing to the reduction in medical comorbidities.

Importantly, exercise can be examined as a differential risk and protective factor in the development of eating disorders, and exercise may even be a beneficial treatment intervention for certain eating disorders. Consequently, when assessing exercise as a component of eating disorder psychopathology, it is particularly important to recognize that exercise can ameliorate some symptoms and exacerbate others.

For instance, Cook et al. (2015) assessed diagnostic differences in exercise and weight suppression between BN and BED in bariatric surgery candidates. Weight suppression was defined as, “the difference between one’s current body weight and highest non-pregnancy adult body weight” (Cook et al., 2015, p. 241). Relative to BED diagnosis, BN diagnosis was associated with higher exercise frequency and greater weight suppression; however, there was a significant interaction between exercise frequency and diagnosis: Weight suppression was comparable for high-exerciser BED and BN groups, but among low-exercisers, weight suppression was higher for the BN than BED group. Therefore, individuals with BED who infrequently exercise may receive weight maintenance benefits by increasing exercise behavior, relative to their BN counterparts. Outside of the context of eating disorders, and within the context of BED specifically, weight maintenance is a positive health outcome; thus, this is an important contribution to understanding how exercise differentially impacts individuals with eating disorders.

Terminology

Physical activity. According to the World Health Organization (WHO), physical activity is "any bodily movement produced by skeletal muscles that requires energy expenditure" (World Health Organization, 2010, p. 53). Importantly, exercise is not synonymous with physical activity; although the terms are frequently used interchangeably, exercise is considered a category subsumed within physical activity. Physical activity includes using bodily movement in a number of activities, in addition to exercise, such as, "working, active transportation, house chores and recreational activities" (World Health Organization, 2010, p. 53). In the current study, the term "physical activity" used to measure the frequency, duration, and intensity that individuals are physically active in the domains of work, active transportation, and leisure time.

Exercise. Exercise is a type of physical activity that is, "planned, structured, repetitive, and purposeful" (World Health Organization, 2010, p. 52). Type of sport used to measure exercise in the current study. Because sports inherently involve repetitive, purposeful practice before planned team and/or individual games, they serve as a useful tool to measure exercise in athletes. Therefore, sports used as an indicator of exercise.

Lean vs. non-lean sports. Sports can be categorized as "lean" or "non-lean" based on characteristic features that promote thin body shape, low weight, and overall lean size or not. Lean sports focus on thinner appearances (Smolak, Murnen, & Ruble, 2000), low weight (Kong & Harris, 2015), and tend to place a high value on overall leanness (Reinking & Alexander, 2005). Lean sports also have specific weight-class requirements or closely monitor weight changes (Kong & Harris, 2015). In general, non-lean sports are the opposite; they do not highlight any body shape, weight, or size concerns because thinner physiques do not necessarily enhance performance in the same way as in lean sports (Kong & Harris, 2015; Smolak et al., 2000). Examples of lean sports

include swimming, dance, gymnastics, and wrestling. In comparison, the following are examples of non-lean sports: lacrosse, football, basketball, and soccer.

Excessive exercise. The term "excessive exercise" has not been well-defined in the extant literature. In fact, researchers use a variety of terms to express similar constructs, such as "obligatory" exercise (Blumenthal, O'Toole & Chang, 1984; Coen & Ogles, 1993) or "exercise addiction" (Glasser, 1976; Morgan, 1979). Overall, research supports the notion that this construct is complex, and therefore, requires a multidimensional approach to conceptualization (Meyer & Taranis, 2011; Steffen & Brehm, 1999).

The Fifth Edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5*) states, "exercise may be considered excessive when it significantly interferes with important activities, when it occurs at inappropriate times or in inappropriate settings, or when the individual continues to exercise despite injury or other medical complications" (American Psychiatric Association, 2013, p. 346). While this is a descriptive definition, there is no clear cut-point to determine when exercise behavior becomes excessive in quantity.

However, the current recommendations from the WHO for weekly physical activity, in adults ages 18-64, may provide an adequate baseline for "healthy exercise." The WHO recommends adults participate in a minimum of 150 minutes (or 2.5 hours) of moderate-intensity physical activity per week (World Health Organization, 2010). In order to gain further health benefits, it is also recommended that individuals increase physical activity to 300 minutes (or 5 hours; World Health Organization, 2010). Excessive exercise, by quantitative definition, should be above this since these recommendations promote overall wellness.

Other researchers have also defined excessive exercise qualitatively as, "compulsive" (Glasser, 1976; Morgan, 1979). Excessive exercise has been measured qualitatively by examining exercise motivations and the negative effects of not exercising (Danielsen, BjØrnelv, & Rø, 2015; Silberstein, Striegel-Moore, Timko, & Rodin, 1988). In general, excessive exercise is most likely comprised of important aspects of both quantitative and qualitative measurements of exercise.

Based on the aforementioned literature, the current study did not have any clinical cut-points for exercise frequency, duration, and intensity to use as a definition of excessive exercise. The current study evaluated exercise by examining the Global Physical Activity Questionnaire (GPAQ; Armstrong & Bull, 2006) and the Exercise and Eating Disorders Questionnaire (EED; Danielsen, Bratberg, & Rø, 2012). See the methods section for more detailed descriptions of the questionnaires.

Motivation. Over time, a plethora of motivation theories have been proposed and several predominant models continue to inform the contemporary motivation theories. For instance, drive-reduction theory suggests that people are inherently born with biological drives that must be met. The biological deficiency (e.g., hunger) initiates behavior (e.g., eating), and once the behavior satisfies the deficit, then the initial drive is reduced (Hull, 1943).

Subsequently, a shift emerged toward more cognitive theories of motivation. Notably, Maslow's (1954) hierarchy of needs suggested that individuals are motivated by a higher-order system of unsatisfied needs. In general, this model of motivation suggests that needs influence behavior and are met accordingly based on degree of complexity.

While most cognitive theories then shifted toward more goal-related actions, some motivational theories (e.g., self-determination theory) continue to posit that certain needs (e.g., autonomy) are important in the consideration of behavior (Deci & Ryan, 2000).

Motivation can also be divided into separated concepts of intrinsic (internal) and extrinsic (external) motivation. Briefly, intrinsic motivation is an inherent interest in an activity without additional, external reward or pressure to initiate the behavior. Conversely, extrinsic motivation is initiating in a behavior in order to obtain a reward or due to outside influence (Ryan & Deci, 2000).

Self-Determination Theory

Definition. Self-determination theory (SDT) is grounded in the investigation of specific social contexts that differentially foster and challenge positive human development (Ryan & Deci, 2000). Self-determined behavior is simply the volition that occurs with any behavior; it is participating in an activity because of inherent interest (Ryan & Deci, 2000; Deci & Ryan, 2000). Motivation is a central component to SDT; at its core, motivation reflects a specific direction and intention for participating in a particular domain of behavior (Ingledew & Markland, 2008; Ryan & Deci, 2000). Despite individuals engaging in similar health-related behaviors, people who are motivated for intrinsic reasons, as opposed to extrinsic reasons, often have more positive health outcomes (Ryan & Deci, 2000).

Additionally, external rewards consistently undermine intrinsic motivation and inhibit overall personal growth (Ryan & Deci, 2000; Deci & Ryan, 2000). For example, experiments have demonstrated that intrinsic motivation can be negatively impacted by monetary rewards, such that the introduction of a financial gain, for the same behavior that was previously intrinsically rewarding, has led to below-baseline levels of behavior (Deci, 1971; Deci, 1972).

One of the critical aspects of enhancing psychological well-being is developing a sense of autonomy, opportunities for self-direction, and choice. Autonomy is also integral to enhancing intrinsic motives and regulating extrinsic motives. SDT posits that

motivation is on a continuum from intrinsic to extrinsic motivation and differentially impacts corresponding behavioral outcomes (Ryan & Deci, 2000; Deci & Ryan, 2000).

Along this continuum, self-determined behavior includes intrinsic motivation, internal self-regulation, and inherent satisfaction. More broadly, less self-determined behavior encompasses extrinsic motivation, external self-regulation, and external rewards. However, within the continuum of less self-determined behavior and extrinsic motivation, more internal self-regulation and autonomy yields more positive quality of life outcomes similar to purely intrinsic motivation. Because intrinsic motivation is by definition, without external pressure and external reward, it is believed to be more inherently rewarding to the self via satisfying a need for a sense of autonomy. To further explore SDT for the purpose of the proposed study, SDT will be examined within the context of physical activity.

Application to exercise. Numerous motives have been identified for participating in sports and exercise (Markland & Ingledew, 1997; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Maltby & Day, 2001). Within the framework of SDT, individuals are more likely to exercise if they are intrinsically motivated and derive inherent satisfaction from physical activity (i.e., enjoy being physically active). However, if exercise is extrinsically motivated (e.g., to lose weight), people are more likely to exercise if it has an internalized significance or value (e.g., to lower blood sugar) and if that value is congruent with other core values (e.g., reduce risk of Type 2diabetes; Ingledew & Markland, 2008). In general, more autonomous motives are associated with sustained engagement in exercise.

Two main exercise motives are fitness/health and appearance/weight. Markland and Ingledew (2007) hypothesized that exercise motivations lie along the self-

determination continuum, such that certain exercise motives reflect more autonomous (i.e., self-determined) behavior than others.

Appearance/weight reasons for exercise are comprised of an introjected regulation style, in which an individual is motivated based on a degree of internalization of external contingencies. An example of an appearance/weight exercise motive is wanting to exercise because you do not feel good about your appearance when you are exercising.

Consistent with Ryan and Deci (2000), this suggests that appearance/weight reasons for exercise are more extrinsically motivated than intrinsically motivated, which correspond to less self-determined behavior. Consequently, appearance/weight motives for exercise reflect an overall lack of autonomous behavior and are associated with more negative consequences, such as negative body image (Ingledew & Sullivan, 2002) and negative affect (Maltby & Day, 2001).

While fitness/health reasons for exercise are also more extrinsically motivated, Markland and Ingledew (2007) acknowledged that health reasons for exercise involve identified regulation. Identified regulation involves the conscious acceptance of behavior; the behavior is believed to be particularly important to the individual in order to achieve valuable outcomes (Ryan and Deci, 2000). Accordingly, fitness/health motives for exercise reflect a greater sense of autonomous behavior and outcomes with more positive psychological well-being, such as enhanced self-esteem, and greater overall participation in exercise (Markland & Ingledew, 2007; McDonald & Thompson 1992).

Overall, the SDT perspective suggests that involvement in exercise for a fitness/health motive reflects greater autonomy, inherent interest in exercise, and will more likely lead to greater positive outcomes. However, exercising for an appearance/weight motives reflects less autonomy and less innate enjoyment in physical

activity. Furthermore, exercising for an appearance/weight motive may be more likely to result in negative health outcomes.

Exercise Motives

Within the SDT framework, extrinsic motivations for exercise, such as appearance/weight reasons, are associated with anxiety, social dysfunction, and depression (Maltby & Day, 2001). However, intrinsic motivations for exercise, such as enjoyment or mood reasons, are related to greater psychological well-being, including enhanced self-esteem (Maltby & Day, 2001).

As suggested, not all exercise motives are equally beneficial or harmful. Outside of SDT, exercising for appearance/weight reasons has also been strongly associated with negative health outcomes, including dieting/restricting behavior, weight and shape concerns, and lower body satisfaction (Gonçalves & Gomes, 2012; McDonald & Thompson 1992; Tiggemann & Williamson, 2000). Individuals who exercised for weight/shape reasons were also more likely to have had a past-month binge-eating episode and report excessive exercising (Gonçalves & Gomes, 2012). Importantly, exercising for health reasons has been associated with heightened self-esteem (McDonald & Thompson 1992; Tiggemann & Williamson, 2000).

Although exercisers at a fitness center were more likely to report engaging in exercise for weight reasons (Gonçalves & Gomes, 2012), most individuals endorse health reasons as their most common exercise motive overall (Tiggemann & Williamson, 2000; Vartanian, Wharton, & Green, 2012). However, women are more likely to engage in exercise for weight control reasons than men (Davis & Cowles, 1991; Silberstein et al., 1988; Smith, Handley, & Eldridge, 1998; Tiggemann & Williamson, 2000). This suggests that women may be at an increased risk for poorer psychosocial outcomes from exercise than men.

Exercise motives are also associated with physical activity behavior. Specifically, appearance- and health-related exercise motives are related to frequency of exercise (Cash, Novy, & Grant, 1994; Smith et al., 1998). Gonçalves and Gomes (2012) found that individuals who exercised for weight reasons were more likely to report excessive exercise behavior than individuals who exercised for health reasons.

Finally, exercise motives have been studied with disordered eating measures. In a cross-sectional study, female college students were assessed for dietary restraint (chronic dieting to control weight and shape), reasons for exercise (health vs. appearance-based reasons), and body image concerns (Vartanian et al., 2012). Although both unrestrained and restrained eaters were motivated to exercise for health-related reasons, restrained eaters were also more motivated to exercise for appearance-based reasons than were unrestrained eaters. Appearance-based reasons for exercise and restrained eating were both significant positive predictors of body image concerns, whereas health-related reasons for exercise were a significant negative predictor.

Exercise Behavior

There has been extensive growth in understanding the relationship between exercise motives, exercise behavior, and disordered eating, but future research must address several gaps in the methodological process. Most researchers who have assessed exercise motives failed to measure or report exercise behavior (Cash et al., 1994; Gonçalves & Gomes, 2012; McDonald & Thompson 1992; Smith et al., 1998; Vartanian et al., 2012). Therefore, when significant associations between exercise motives and disordered eating have been delineated, there is a lack of context provided because no physical activity behavior is reported. Without knowing participants' current physical activity behavior, it is unclear if exercise is meaningful to them. For instance, exercise motives may vary significantly among participants who exercise daily compared with

participants who exercise once or twice a week. Additionally, individuals who do not exercise at all should not answer exercise motivation questions since they are not engaging in exercise behavior. Rather, it would be more important to understand their reasons for not engaging in exercise (i.e., barriers). Overall, it is imperative to provide information on participants' current physical activity behavior so that the relationship between exercise motives, exercise behavior, and disordered eating is clear.

In a study examining exercisers at a fitness center, participants indicated their type of exercise and exercise frequency. However, Gonçalves and Gomes (2012) only ostensibly reported exercise information by indicating the proportion of individuals who exercised excessively, but there is no clear operational definition of "excessive exercise" in the methodology. This information is particularly critical given this sample was regularly exercising at a fitness center, and these results may not be as generalizable to other forms of exercise.

In a factor analysis of the Reasons for Exercise Inventory (REI; Cash, Novy, & Grant, 1994), participants' exercise behavior was not reported. While the authors indicated that exercise was assessed by asking about frequency of physical activity per week, no information is provided on the overall rate of physical activity involvement. Notably, Cash et al. (1994) specified that individuals who, "lack[ed] regular exercise" were excluded from analyses (p. 540); however, the physical activity behavior of participants included in the analyses was not described.

In Vartanian et al.'s (2012) sample, it would have been particularly helpful to include a measure of exercise behavior to provide a context for how physically active the participants were because all of the participants were young, female college students with a reported normal/healthy weight. All of these factors may have played a role in the

relationship between exercise motives and disordered eating; thus, understanding the participants' level of exercise behavior can make it easier to generalize the findings.

Overall, in order to better understand the relationship between exercise motives and disordered eating behavior, exercise behavior must be assessed. Without adequate information on exercise frequency, duration, and intensity in the sample, it is unclear what role exercise plays by only assessing motivation for exercise. That is, the extent to which people are exercising may play an important, but yet poorly understood, role in the well-documented relationships between exercise motives and disordered eating. For example, people who have weight-related reasons for exercising and rarely exercise may report lower levels of maladaptive eating behavior (thus, their reasons for exercise are not as important because they do not engage in the behavior); people who have weight-related reasons for exercising and frequently exercise may engage in higher levels of maladaptive eating behavior as a compensatory strategy (thus, their reasons for exercise are very important since they engage in the behavior). A number of other potential interactions between exercise motives and physical activity behavior on disordered eating outcomes can easily be imagined, but many of these hypotheses have yet to be tested.

In the few studies that report exercise behavior, most fail to indicate their methodological approach to assessing exercise frequency, duration, and/or intensity (Davis & Cowles, 1991; Smith et al., 1998). Researchers indicate that exercise information is collected, but physical activity and the variables subsumed within exercise behavior (i.e., types of sports) are not well-defined. This becomes problematic because it is difficult to synthesize information across various studies when central variables are only minimally described in the methodology.

For instance, Davis and Cowles (1991) indicated that subjects self-identified as regular exercisers (i.e., in an aerobic class or "self-styled exercise program," p. 35),

recreationally interested in exercise, and assiduous exercisers. Unfortunately, there is no clear explanation regarding how to measure any of those types of exercise, even if the participant is self-evaluating their level of exercise. Additionally, Davis and Cowles (1991) attempted to quantify physical activity by assessing frequency and duration of participation in a list of limited exercise activities, but then they collapsed all of the exercise activities together and only reported physical activity as a total sum. Because the participants identified themselves along a continuum of physical activity participation and therefore, may have differentially participated in certain types of physical activities, it would be important to describe the types of activities in which each group of participants were most active.

Standard measures of physical activity are not commonly used when exercise information is collected to compare this association with exercise motives (Maltby & Day, 2001; McDonald & Thompson, 1992). Consequently, consistent exercise behaviors are not compared with exercise motives, which creates a gap in understanding how the reasons for exercise are associated with physical activity behavior. Furthermore, there is a lack of consensus regarding the prominent factors that should be included when assessing physical activity type, duration, frequency, and intensity level. Without standardization, it remains difficult to replicate findings.

Maltby and Day (2001) indicated that exercise behavior is operationally defined in two divergent ways, as “exercising” and “participation in sports” (p. 653). Although it may not have been important to differentiate two different types of “regular exercise” for the purpose of Maltby and Day’s (2001) analysis, it is vital to clearly understand and standardize the two types subsumed underneath “regular exercise” (p. 653). For instance, Maltby and Day (2001) suggested that swimming is not a sport, whereas golf is a sport. However, swimming at a competitive level is recognized as a sport, and some individuals

recreationally play golf without competing. Therefore, relying on unstandardized measures of exercise type makes understanding exercise information fundamentally challenging.

McDonald and Thompson (1992) explored gender differences between exercise motives and disordered eating. Physical activity was comparable across groups and averaged approximately 60 minutes per day. A self-report exercise activity questionnaire was completed; however, it was unclear what specific questions were assessed, including how exercise intensity was operationalized. Specific exercise activities were coded into four higher-order categories (e.g., weight training, water sports, field sports, and aerobics), but which sports were subsumed underneath each of the classifications remains ambiguous.

In addition, McDonald and Thompson (1992) did not provide support from theory or the extant literature for their higher-order categorization. It was also noted that "regular and serious exercisers" were tested in their study (McDonald & Thompson, 1992, p. 290); however, without an operational definition of those terms, interpreting the sample's behavior is difficult. Overall, because of the lack of standardized measures of physical activity (i.e., exercise frequency, duration, and intensity), understanding and interpreting the sample's exercise behavior is compromised.

Recently, there has been an attempt to synthesize and converge some of the aforementioned inconsistencies in the literature in a new measure called the Exercise and Eating Disorders Questionnaire (EED; Danielsen, Bratberg, & Rø, 2012). The EED purports to measure dimensions of compulsive and unhealthy exercise within the context of eating disorders. Based on experience with an all-female inpatient eating disorder unit, the EED items were developed and compared against a disordered eating measure. The EED is uniquely designed to evaluate the motivation for exercising as it relates to

pathological eating behavior because the excessive exercise components of the measure are directly embedded into each item in the measure. This differs from other measures that rely on bivariate associations to demonstrate a strong relationship between excessive exercise and disordered eating.

In a validation study conducted by the original authors, Danielsen and colleagues (2015) revealed that the EED subscales assessing compulsive elements of exercise were highly correlated with the Eating Disorder Examination Questionnaire (EDE-Q; Fairburn and Beglin, 2008) Weight Concern and Shape Concern subscales. While the EED has been compared to a well-known disordered eating measure, the EED has not been validated against an exercise questionnaire. Furthermore, the EED has only been examined in an eating disorder inpatient setting, and it has not been evaluated on men. Based on the current literature, the EED appears to be psychometrically sound (see Method). However, until subsequent analyses are conducted by external researchers, the EED's current utility is debatable. Therefore, the current study examined the EED, providing additional data to explore the extent to which this measure may provide more meaningful information about exercise behavior. Specifically, the current study used a new sample population (i.e., convenient sample of college students), a new gender (i.e., assessed men), and compared the EED with a standardized exercise questionnaire (i.e., REI).

Athletes and Disordered Eating

Athletes, compared with non-athlete exercisers and sedentary individuals, may be at a particularly high risk for the development of eating disorders due to sports' inherent focus on lean physique/fitness for success and competitive nature. Athletes may be more successful in certain sports when they are lean, which may lead to pressure to be thin (Sundgot-Borgen, 1994). Leanness is viewed as a performance-enhancing quality (Currie,

2010), such that heavier athletes are expected to be slower and less flexible (Brownell, Rodin, & Wilmore, 1992). Therefore, pressure to be successful at one's sport and play a sport at competitive levels (i.e., elite, national, international) may incrementally increase the desire for thinness, weight/shape concerns, and overall disordered eating problems.

In a meta-analysis examining disordered eating among athletes, 33 studies were selected with female athletes, and a comparison group was drawn from either female non-athletes or female athletes who completed a measure with an available standard, norm comparison (Smolak et al., 2000). Unfortunately, several studies failed to indicate which sport the athlete participated in; therefore, this limited analyses assessing which athletes were at a higher risk for pressure to be lean.

Overall, athletes had more disordered eating problems than non-athletes. Additionally, athletes participating in lean sports (e.g., dance, ballet, cheerleading) were significantly more likely to have disordered eating behavior than non-athletes. Furthermore, elite athletes (i.e., individuals participating in college or minor league sports), were at an especially high risk for disordered eating. Specifically, elite dancers, compared with asymptomatic non-dancer controls, had higher rates of disordered eating. Importantly, athletes participating in elite, lean sports were also at a higher risk for disordered eating, compared with healthy controls. Because participating in elite sports and lean sports independently increased the risk for disordering eating problems, the combination of elite, lean sports may uniquely place individuals at a cumulative risk for higher disordering eating.

While athletic participation may appear to be only connected to higher levels of disordered eating behavior, Smolak et al. (2000) also found that individuals who participated in non-elite, non-lean sports scored lower on measures of disordered eating compared with non-athletes. This indicates that athletic participation in these types of

sports (e.g., soccer, tennis, softball) may be protective and could be encouraged for girls and women.

Overall, this meta-analysis reveals that athletic participation per se does not necessarily contribute to disordering eating risk; rather, specific features of athletic participation produce additional risk. Because this meta-analysis solely focused on literature examining female athletes, it is difficult to know whether this is generalizable to male athletes.

Fortunately, Chapman and Woodman (2015) recently conducted a meta-analysis examining disordered eating in male athletes. Thirty-one studies were included in the analysis, comparing male athletes and non-athletes. Although there was significant heterogeneity, there was no difference in the overall disordered eating scores among athletes and non-athletes, and athletes independently participating in lean sports or elite sports and non-athletes. This evidence suggests that lean sports and elite sports may not increase the risk for disordered eating in male athletes as they do in female athletes. Additionally, male athletes participating in mass-dependent sports (e.g., wrestling, karate, judo, etc.) and non-athletes were not significantly different in their levels of disordered eating. However, when assessing wrestling independently, athletes had significantly higher rates of disordered eating than controls. Therefore, male athletes may be differentially impacted by disordered eating as a function of specific mass-dependent sports. Without researchers consistently describing which sports their participants are engaging in, it is difficult to tease apart which mass-dependent sports are most relevant for analysis in male athletes. It is important to note that within the context of eating disorders, male body and eating concerns appear to be markedly different from female concerns; consequently, Chapman and Woodman (2015) suggest generalizing these results cautiously.

While two large meta-analyses have made significant contributions to the literature on female and male athletes, several questions remain. Little research has explored athletes' risk for eating disorder development by examining all of the key components that have been established as risk factors outside of the context of athletics. Specifically, researchers typically focus on the type of sports, such as lean or elite level, but do not incorporate other aspects of exercise (i.e., exercise frequency, duration, and intensity, and exercise motives).

In a study of over 1,500 athletes, disordered eating (measured by the EDE-Q) and National College Athletics Associations (NCAA) sport type were examined. Darcy and colleagues (2013) indicated that elite athletes were less likely to have disordered eating symptoms than non-athletes/non-regular exercisers. However, because this sample combined male and female athletes, and no direct comparison was analyzed between groups, it is unclear if gender played a significant role in elite sport status. Furthermore, because many of the participants practiced more than one sport, and the specific type of sports was not outlined, distinct conclusions that elite sports serve as a protective factor against disordered eating is premature. If a high proportion of participants is practicing multiple sports at different levels (i.e., national and international), then this must be accounted for before firm conclusions can be made.

Certainly, more attention is needed to understand the connection between sport type (e.g., lean sports) and disordered eating outcomes. A relationship has been established between exercise motives and disordered eating outcomes, but understanding athletes' motives for exercise is also important. While research to date has examined exercise motives for participating in sports, researchers have not explicitly examined these constructs in a sample of athletes. Therefore, an important next step is to examine all of these factors simultaneously, with a sample of athletes, in order to better understand

the complex nature of how exercise is a differential protective and risk factor for disordered eating.

Pilot Data

Sienko Thesis (2011; downloaded from http://commons.emich.edu/theses/373/). To provide information about likely rates of binge eating disorder (BED) in the undergraduate population, a previous master's thesis (Sienko, 2011) was reviewed. That study was conducted to assess BED in a convenience sample of 295 female undergraduates. Using methodology similar to that of the proposed study, participants were recruited from the SONA research system and in-class announcements. Only 2.4% (n = 7) of participants met full BED criteria, while sub-threshold binge eating behavior was endorsed by 10.5% (n = 31) of participants. The low prevalence BED found in this study led to the hypothesis that individuals may under-report binge eating symptoms. However, this study only examined female college students; therefore, cautious interpretations are warranted. Regardless, the *DSM-5* (American Psychiatric Association, 2013) suggests the prevalence of BED among adults is 1.6% in females and 0.8% in males. Therefore, this study found higher rates of full BED criteria than expected. Nevertheless, because the prevalence of BED is extremely low in the general population, significant over-recruitment of the convenience sample would be required in order to obtain sufficient statistical power to run the applicable analyses. Additionally, meaningful knowledge is gained and disseminated when sub-threshold binge eating behavior is examined. Given the higher prevalence of sub-clinical levels of eating problems in the reviewed master's thesis population, and the concerns of insufficient statistical power to analyze full BED criteria, the current study examined sub-threshold levels of eating disorders (i.e., binge eating behavior and other disordered eating behavior).

Pilot Study: Athletes in NCAA and Intramural/Club Sports. To provide information about the rates of NCAA and intramural/club athletes in a convenient sample of undergraduates, a pilot study was conducted. The university's institutional review board approved the pilot study. The pilot study used similar methodology to the proposed study, and participants were recruited from the SONA research system. Overall, a total of 933 participants (68.0% female) completed the study.

While the purpose of the study was to examine rates of NCAA (n = 56, 6.5%) and intramural/club athletes (n = 46, 5.3%), analyses revealed key methodological challenges. For instance, because the study only assessed NCAA and intramural/club athletes, there were no data on the rates of participation in community sports apart from the those on-campus. This may provide some insight for the low frequency in reported athletic involvement. Additionally, one-third (n =15) of the intramural/club athletes used the "other" option to indicate what sports they participated in, suggesting that the measure was not adequately describing their types of sports. Given the high rate and type of written responses in the "other" option for intramural/club sports (e.g., volleyball, softball, etc.), it is evident that sports are applicable at both levels of participation and not limited to just NCAA. This provided support for our decision to eliminate grouping the measure by level of sport participation (i.e., NCAA vs. intramural/club), and ask this in a separate question.

Another goal of the study was to collapse the NCAA and intramural/club athlete groups into a larger, combined athletic group, and then assess lean and non-lean sports. However, 22 participants did not indicate what sport they participated in; therefore, the lean and non-lean groups are not likely representative of the sample and were statically under-powered. Regardless, the NCAA and intramural/club athlete groups were collapsed

into a larger group of 102 participants. Then, the combined athlete group was divided by lean and non-lean sports, resulting in 14 lean sport athletes and 66 non-lean sport athletes.

Because there was a particularly insufficient level of participation in lean sports, additional inspection of the measure was conducted to make future revisions. Upon inspection, findings revealed that the original measure used to assess athletic involvement included numerous redundant sports. Multiple sports were duplicated in the list of athletic involvement activities because each sport that was applicable to both men and women was listed separately for both genders (e.g., men's basketball and women's basketball). Presumably the specific type of sport pertaining to gender, such as women's basketball, can be accounted for in analyses with the variables gender and sports, separately, rather than including both sports in the list. While this does not account for insufficient statistical power, in an effort to decrease additional participant burden with twice as many unnecessary choices for athletic sports, the present study simplified language by describing sports as applicable to both genders (e.g., basketball).

Additionally, findings revealed that sports in the athletic involvement measure were listed idiosyncratically (i.e., not in any particular order), making it difficult to read the list quickly. Accordingly, in order to decrease potential participant attrition rates, and increase accuracy, the present study re-organized the list of sports into alphabetic order.

Overall, based on the numerous methodological challenges with our pilot data, initial findings questioned the feasibility of assessing athletes in a convenience sample. However, analysis of the pilot study also revealed important ways of assessing athletic involvement in a more meaningful way. Because the extant literature rarely reports any data on how this information is assessed (i.e., athletic involvement demographics), it is important to test novel ways of assessing athletic involvement and then adapt the measure to form the best approach for assessing the construct.

Pilot Study: Athletes in Lean vs. Non-lean Sports. Based on the previous pilot study, an additional pilot study was conducted in order to improve the methodology of assessing athletic involvement in a convenient sample. Specifically, the study assessed the prevalence of sports (e.g., swimming, soccer, etc.) and levels of sport participation (e.g., NCAA, intramural/club, community, and recreational exercise). The university institutional review board approved the pilot study. Participants were recruited via the SONA research system. A total of 724 undergraduate students (75% female) completed the study. Of those, 411 students indicated that they participated in one of the following activities: NCAA sports (n = 36), intramural/club sports (n = 57), community sports (n = 55), and/or recreational exercise (n = 263). The remaining 313 participants specified that they did not participate in any physical activity or exercise. Importantly, these findings strongly support the feasibility of examining an athlete population within a convenient college sample.

Additionally, the levels of sport participation (e.g., NCAA, intramural/club, and community) were collapsed in order to assess the feasibility of examining lean and non-lean sports in a convenient college sample. Therefore, recreational exercise was excluded for these analyses. Of the 148 participants in NCAA, intramural/club, and community sports, a total of 92 individuals participated in lean sports, and 56 individuals participated in non-lean sports. Therefore, this pilot study provided evidence for the feasibility of assessing an athlete population in a convenience sample. Certainly, the improvement in assessing athletic involvement over the previous study most likely contributed to the increase in rates for both levels of sport of participation and specific types of sports. The current study used a similar methodology to the pilot study to examine athletic involvement.

Rationale for the Present Study

While the literature clearly demonstrates psychological and physiological benefits associated with exercise, it is less clear how to examine negative consequences associated with exercise (e.g., disordered eating outcomes) due to the lack of reported physical activity behavior (i.e., frequency, duration, and intensity), or the lack of standardized measures used to report physical activity behavior (e.g., results indicate "regular" exercisers or participants "excessively" exercised.).

To the best of my knowledge, no study to date has used the standardized measure Global Physical Activity Questionnaire (GPAQ) to assess physical activity behavior in the same study as exercise motivations. Thus, the proposed study contributes to the literature by using a standardized measure of physical activity, which should make evaluating this this research easier.

Additionally, the extant literature supports the notion that athletes participating in lean and elite sports are particularly at risk for disordered eating (especially female athletes); however, there appears to be no research to date that has examined athletes' exercise motives. Therefore, the proposed study assessed athletes' exercise motives in order to better understand if athletes are at a higher risk for disordered eating because exercise motives may also provide insight for some of the gender differences in athletes and disordering eating outcomes.

Finally, the proposed study examined the new Exercise and Eating Disorders Questionnaire (EED), which has only been published by the original research team. The proposed study will contribute to the validation of this measure by examining a broader sample (i.e., including males and college students) and comparing it to an exercise measure (i.e., the REI).

Based on the extant literature and the aforementioned pilot data, the following hypotheses were tested.

Primary Research Questions.

Hypothesis One. It was hypothesized that exercise motives, measured by the Reasons for Exercise Inventory (REI), would be associated with disordered eating. A relationship between the REI Stress/Mood Management subscale and emotion regulation, measured by the Emotional Eating Scale, was examined on an exploratory basis. Because emotional antecedents to binge eating seen in emotional eating could account for more variance than mood-related exercise motives when predicting eating outcomes, it is important to cautiously examine the REI Stress/Mood Management subscale. Measures of disordered eating included the following: Eating Disorder Examination Questionnaire (EDE-Q) Restraint, EDE-Q Eating Concern, EDE-Q Shape Concern, and EDE-Q Weight Concern subscales, EDE-Q global scale, and the Binge Eating Scale total score (BES).

Hypothesis Two. It was hypothesized that physical activity behavior, measured by the Global Physical Activity Questionnaire (GPAQ), would have a weak and non-significant association with measures of disordered eating.

Hypothesis Three. It was hypothesized that the physical activity behavior would moderate the relationship between exercise motives and disordered eating. Analyses from hypothesis one suggesting that exercise motives predict disordered eating outcomes supported the relationship.

Hypothesis Four. It was hypothesized that sport type would be associated with disordered eating; therefore, independent-samples *t*-tests were conducted to compare lean and non-lean sports on measures of disordered eating.

Hypothesis Five. It was hypothesized that exercise motives would moderate the relationship between sport type and measures of disordered eating.

Hypothesis Six. It was hypothesized that exercise motives and physical activity behavior would moderate the relationship between type of sport and disordered eating.

Hypothesis Seven. It was hypothesized that there would be good convergent validity between the EED and the EDE-Q, and good convergent validity between the EED and the REI.

Hypothesis Eight. It was hypothesized that the EED could account for additional variance, after controlling for the REI, when predicting disordered eating outcomes.

Secondary Research Questions.

Depression and anxiety were evaluated as covariates in secondary analyses.

Method

Participants

A total of 1,206 participants were recruited for the current study. Following study completion, 196 participants were eliminated from analyses for one of the following reasons: completing the study multiple times (N = 17), or answering validity items incorrectly (N = 179). Validity items explicitly provided participants the answer to the question; as such, the correct answer was guaranteed if participants were paying attention and not completing the survey in a haphazard (i.e., invalid) fashion. Three validity items were embedded within the online survey in order to assess participants' consistent attention throughout their involvement in the study.

A valid sample for the present report (N = 1010) was comprised of 65.2% women (N = 659) between the ages of 18 and 69 (M = 21.32, SD = 5.49) who were primarily single (i.e., never been married; N = 796, 78.8%). The sample was 67.7% Caucasian, 17.1% African American, 2.1% Hispanic, 3.2% Asian, 2.4% Middle Eastern, and 6.0% Multi-racial. A majority of the sample indicated their household economic status was "solidly middle class" or above (N = 430, 42.6%). Most participants endorsed currently

working toward a bachelor's degree (68.0%, *N* = 679). On average, participants were taking 13.62 college credits in the current semester (*SD* = 3.31), or taking 5.02 college classes in that semester (*SD* = 1.23). Over half of the sample (64.1%, *N* = 646) was employed at least part-time, working an average of 19.38 hours per week (*SD* = 15.56).

The average height of participants was 66.91 inches (*SD* = 6.67), and the average weight was 162.60 pounds (*SD* = 42.71). Participants' average BMI was 25.62 (*SD* = 6.10). The sample was comprised of the following BMI categories: 3.9% underweight (*N* = 39), 51.3% normal weight (*N* = 518), 25.8% overweight (*N* = 261), and 17.5% obese (*N* = 177).

Design

The proposed study used a cross-sectional design. The aim of the study was to investigate how physical activity can be a differential risk factor and protective factor in the development of disordered eating by examining exercise motives and physical activity behavior (i.e., frequency, duration, intensity, and type).

Measures

Demographic Information. A demographic questionnaire assessed the following information: age, gender, height, weight, weight status, education, race/ethnicity, sexual orientation, socioeconomic status, marital status, employment status, pregnancy status, physical disabilities, medical conditions, and athletic involvement (i.e., sports and recreational physical activity; see Appendix A).

A list of athletic involvement activities included a combination of items derived from the Eastern Michigan University (EMU) Databook (2015), extant literature on salient sports (Kong & Harris, 2015; Reinking & Alexander, 2005; Smolak et al., 2000), and the aforementioned pilot study. Based on the literature, sports were categorized as lean and non-lean. The following sports were classified as lean sports: bodybuilding,

boxing/kickboxing, cheerleading, cross country, dance team/dance troupe, gymnastics, figure skating, judo/jujitsu/sombo, mixed martial arts, rowing, sailing, swimming and diving, track and field, wrestling, and weight lifting. Non-lean sports included the following: baseball, basketball, bowling, disc golf/ultimate frisbee, dodgeball, equestrian/horseback riding, flag football/football, golf, hockey/ice hockey/roller hockey, lacrosse, racquetball, soccer, softball, tennis, volleyball, and water polo. The remaining athletic involvement activities were not categorized as lean or non-lean sports; they were simply classified as recreational physical activities: jogging, running, salsa, and Zumba/pilates. The list of recreational physical activities, included in the list of athletic involvement activities, was derived based on the EMU Databook (2015) and classes offered in the surrounding community, such as Salsa and Zumba.

Reasons for Exercise Inventory (REI). Exercise motivations were measured by a modified version of the self-report Reasons for Exercise Inventory (REI; Silberstein, Striegel-Moore, Timko, & Rodin, 1988). Silberstein et al., (1988) created the original 24-item REI to assess motivations for exercise, which included seven subscales: Health, Fitness, Attractiveness, Weight Control, Tone, Mood, and Enjoyment. Participants were asked, "To what extent is each of the following an important reason that you have for exercising?" Participants rated the reasons for exercise on a 7-point scale, from 1 (*not at all important*) to 7 (*extremely important*). Each subscale has three or four items, and internal consistency reliability is strong (α = .67–.81). There are no reverse scored items. Total scores can range from 7 to 175, and subscales utilize weighted mean scores to account for the different quantity of items in each scale. Higher scores reflect higher levels of each motivation for exercise.

In the current study, participants completed the 25-item version of the REI utilized by Cash, Novy, and Grant (1994). In Cash et al.'s (1994) study, the original questions and

the 7-point rating scale were maintained, and one additional social reason for exercise was added (i.e., “to do what is socially expected” to the enjoyment subscale). Cash et al.’s (1994) factor analysis revealed four higher-order subscales for the REI: Fitness/Health Management (α = .91), Appearance/Weight Management (α = .89), Stress/Mood Management (i.e., relabeling the Mood subscale; α = .88), and Socializing (i.e., adding one new question and relabeling the Enjoyment subscale; α = .73). Additionally, two items did not load onto any single factor (i.e., an item from the Fitness subscale: “to improve my muscle tone” and an item from the Weight Control subscale: “to maintain my current weight”). The current study used the four-factor structure for analysis purposes.

Recently, Strelan, Mehaffey, and Tiggemann (2003) used the original 24-item REI, and they found internal reliabilities to be acceptable (α = .72-.88) for all subscales except weight control. After removing one item from the Weight Control subscale (i.e., “to maintain my current weight”), alpha increased from .54 to .78. Importantly, one of the items that did not originally load onto any of the factors in Cash et al.’s (1994) factor analysis was included in Strelan et al.’s (2003) analysis (i.e., “to improve my muscle tone” in the Fitness/Health subscale). Thus, this item was included in the Fitness/Health Management subscale in the current study.

Based on intercorrelations between the subscales, and to simplify interpretation, Strelan et al. (2003) collapsed the subscales into three distinct domains: fitness/health, appearance (combining Attractiveness, Weight Control, and Tone), and Mood/Enjoyment. Strelan et al.’s (2003) subscales paralleled Cash et al.’s (1994) factor analysis except for the combined mood/enjoyment subscale. Although Strelan et al.’s (2003) analysis indicated that the Mood and Enjoyment subscales were highly correlated (r = .61), Cash et al.’s (1994) factor analysis revealed that the individual items on each

subscale did not converge onto one subscale. Therefore, the current study deferred to the four-factor structure of the REI in Cash et al.'s (1994) analysis.

Additionally, the current study considered removing one item from analyses (i.e., "to maintain my current weight") because both Cash et al. (1994) and Strelan et al. (2003) determined the measure was statistically superior without it. Analyses were run with and without the item, and no statistically significant changes occurred. Therefore, the item was retained for analyses, and only the analyses with the item were reported for ease of interpretation.

Furthermore, the current study altered the language of the item "to be attractive to members of the opposite sex" to "to be physically attractive" in other to reduce biased wording and maintain the original intent of the statement (see Appendix B).

Global Physical Activity Questionnaire (GPAQ). Physical activity behaviors were measured by the Global Physical Activity Questionnaire (GPAQ; Armstrong & Bull, 2006), which is a 16-item questionnaire developed by the World Health Organization (WHO) as part of the WHO STEPwise approach to chronic disease risk-factor surveillance (World Health Organization, 2005). Briefly, the WHO STEPS instruments cover different levels or "steps" of risk assessments. The current study only used a step one assessment (i.e., a questionnaire). This questionnaire assesses physical activity (i.e., frequency, duration, and intensity), and organizes the type of physical activity under three domains, including: work, transportation, and leisure time. Respondents were asked to think about the time they spend doing different types of physical activity in a typical week. An example of a question for the work domain is, "Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate for at least 10 minutes continuously?." For the transportation domain of the GPAQ, a sample item is, "Do you walk or use a bicycle for at least 10

minutes continuously to get to and from places?" The leisure time domain includes items such as, "Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause small increases in breathing or heart rate for at least 10 minutes continuously?" Therefore, participants only endorse some type of physical activity behavior if they engage in the activity for at least 10 minutes.

Total physical activity is a composite score, combining the weekly rates of physical activity within each the three domains. A Metabolic Equivalent (MET) is used to express the intensity of the physical activity, once the composite score has been determined. Moderate-level physical activity is equivalent to 4 METS, and vigorous-level physical activity is equivalent to 8 METS (see Appendix C).

Herrmann, Heumann, Der Ananian, and Ainsworth (2013) found acceptable, 10-day reliability coefficients (r = .83–.96) and slightly lower three-month reliability coefficients (r = .53–.83) for the GPAQ. Physical activity intensity categories (i.e., low-, moderate-, and vigorous-intensity) had strong reliability (r = .76–.83), and domain-specific categories (i.e., work, transport, and leisure time) were moderate (r = .53–.68). Additionally, Herrmann et al. (2013) found that moderate and vigorous minutes of physical activity on the GPAQ correlated with moderate (r = 0.28) and vigorous (r = 0.48) accelerometer physical activity.

Bull, Maslin, and Armstrong (2009) demonstrated concurrent validity between the GPAQ and the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003; r = 0.45–0.65). There was an acceptable level of association with Spearman's rho coefficients ranging from 0.45 for total moderate-intensity physical activity to 0.57 for total vigorous-intensity physical activity. A moderate association between GPAQ and IPAQ was seen for total physical activity (r = 0.54).

Eating Disorder Examination Questionnaire (EDE-Q). The Sixth Edition of the Eating Disorder Examination Questionnaire (EDE-Q 6.0; Fairburn and Beglin, 2008) is a 28-item self-report version of the Eating Disorder Examination (EDE; Fairburn and Cooper, 1993) used to assess the attitudes and behavioral features of eating disorders.

Although the EDE is considered the "gold standard" for diagnosing eating disorders (Crowther & Sherwood, 1997; Fairburn & Beglin, 1994; Hulley & Hill, 2001; Loeb et al., 2007; Wilson & Smith, 1989), clinicians and researchers require more cost-effective ways of screening individuals for the core psychopathology of these disorders. Therefore, the EDE-Q provides an economical and feasible alternative to the EDE clinical interview.

In the EDE-Q, respondents were asked to indicate the frequency of their eating attitudes and behaviors over the past 28 days on a 7-point scale, from 0 (*no days*) to 6 (*everyday*). The EDE-Q provides frequency data on number of days per month that a behavior has occurred and subscale scores to reflect the severity of key features of eating disorders. The subscales consist of: Restraint, Eating Concern, Shape Concern, and Weight Concern. Subscales include 22 of the items and are calculated with weighted mean scores to account for the different quantity of items in each subscale. Subscales can still be calculated as long as more than half of the items are rated. A global score is calculated by adding the four subscale scores and dividing by the number of subscales (i.e., four). Total global scores can range from 0 to 132. Higher subscale and global scores indicate higher levels of eating disorder features. The remaining 6 items on the questionnaire provide additional information about attitudes and behavioral features of eating disorders (e.g., binge eating and compensatory responses; see Appendix D).

Using an earlier version of the EDE-Q (i.e., a 41-item version), Luce and Crowther (1999) found acceptable internal consistency and good two-week test-retest

reliability in a sample of undergraduate women for each subscale: Restraint (α = .84–.85, *r* = .81), Eating Concern (α = .92–.93, *r* = .94), Shape Concern (α = .89, *r* = .92), and Weight Concern (α = .78–.81, *r* = .87).

Additionally, the EDE-Q was found to have good concurrent validity when examined against the EDE in a community sample of women (M_{age} = 35.3, *SD* = 8.5; Mond, Hay, Rodgers, Owen, & Beumont, 2004). Mond et al. (2004) used an earlier version of the EDE-Q (i.e., a 36-item version) and explicitly indicated that the subscale and global scores were derived from the 22 items examining eating disorder psychopathology modeled after the EDE. The EDE and EDE-Q were highly correlated on each of the subscales: Restraint (*r* = .57, *p* < .001), Eating Concern (*r* = .77, *p* < .001), Shape Concern (*r* = .75, *p* < .001), and Weight Concern (*r* = .73, *p* < .001), and on the global score (*r* = .79, *p* < .001).

In a study examining outpatient males (*n* = 15) and females (*n* = 67) in a randomized controlled clinical trial for BED (M_{age} = 42.1, *SD* = 9.8), the 41-item version of the EDE-Q had good convergent validity with the EDE (Grilo, Masheb, & Wilson, 2001). All of the subscales were correlated with each other: Restraint (*r* = .69, *p* < .001), Eating Concern (*r* = .33, *p* < .01), Shape Concern (*r* = .56, *p* < .001), and Weight Concern (*r* = .66, *p* < .001).

Binge Eating Scale (BES). The Binge Eating Scale (BES; Gormally, Black, Daston, & Rardin, 1982) is a 16-item self-report measure that assesses binge eating behavior. Gormally et al. (1982) developed the BES items based on experience treating individuals with binge eating and the third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III)* criteria for binge eating in bulimia (American Psychiatric Association, 1987). Half of the items measure the behavioral manifestations associated with binge eating, and the other half of the items measure feelings and

cognitions associated with binge eating. Respondents are asked, “Below are groups of numbered statements. Read all of the statements in each group and indicate on this page the one that best describes the way you feel about the problems you have controlling your eating behavior.” The BES is scored by totaling the values from each of the 16 items. Scores can range from 0 to 46. Severity levels for binge eating are none (0 to 17), moderate (18 to 26), and severe (27 to 46; see Appendix E).

The original measure was developed to assess binge eating among obese treatment-seeking individuals. Gormally et al. (1982) found that the BES discriminated among individuals with no binge eating, moderate binge eating problems, and severe binge eating problems and yielded internally consistent scores ($\alpha = .85$). The BES has concurrent validity with measures of binge eating severity from 28-day food records (r = .39–.40) and adequate test-retest reliability ($r = .87$) among participants who engage in non-purging, binge eating behavior (Timmerman, 1999). With a threshold of 27, the BES demonstrated sufficient sensitivity (60.6%), specificity (95.2%), positive predictive value (57.1%), and negative predictive value (95.8%) among obese patients with and without BED (Ricca et al., 2000).

Similarly, Grupski et al. (2013) found the BES to be a valid screener for BED in bariatric surgery patients. When Grupski et al. (2013) used a conservative cut-off score of 17, the BES correctly identified 78.4% with BED, and it demonstrated good sensitivity (r = .94), specificity ($r = .76$), and negative predictive value ($r = .99$). With a conservative threshold of 27 for BED classification, the BES correctly identified 87.9% with BED, and positive predictive value improved ($r = .56$).

Recently, a confirmatory factor analysis of the BES was conducted among participants undergoing bariatric surgery (Hood, Grupski, Hall, Ivan, & Gorsica, 2013). Hood et al. (2013) determined that the one-factor model provided adequate fit for the

BES (α = .87); however, the two-factor model of behaviors and feelings/cognitions provided a statistically superior fit (α = .79 for each factor). Hood et al.'s (2013) findings were replicated, and the two-factor structure for the BES was supported, with fit significantly better than the one-factor model (Marek, Taresavage, Ben-Porath, Ashton, & Heinberg, 2015). However, the two factors were considerably correlated (*r* = .89). While the feelings/cognitions factor was modestly associated with self-reported mood and anxiety psychopathology, the behaviors factor was not related with behavioral problems. Additionally, only 3 out of the 8 items on the behaviors factor had significant factor loadings in the expected direction. Therefore, Marek et al. (2015) recommended clinicians continue using the BES as a unidimensional measure and caution interpretation of the BES as a two-factor measure. Because there are no current cut-off scores for binge eating severity using the two-factor model, and in light of its limited incremental utility, the present study utilized the one-factor model in order to categorize binge eating severity based on the extant literature.

Questionnaire on Eating and Weight Patterns-5 (QEWP-5). The Questionnaire on Eating and Weight Patterns-5 (QEWP-5; Yanovski, Marcus, Wadden, & Walsh, 2015) was originally created and utilized in the field trials for the proposed criteria for binge eating disorder (BED). These criteria were included in the fourth edition and fourth edition text revision of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, DSM-IV TR;* American Psychological Association, 1994, 2000). With modifications made to criteria in the *DSM-5*, applicable updates have been made to the measure (see Appendix F).

In short, the QEWP-5 is a 26-item measure used to screen for possible diagnoses of BED and BN. Respondents are asked to evaluate some questions on a discrete "yes" or "no" classification for certain behaviors, while other questions are on a 6-point scale from

1 (*less than once per week*) to 6 (*14 or more per week*) to evaluate the specific frequency of certain behaviors. Skip logic is used throughout the measure so that respondents only evaluate questions that are appropriate for them to answer (i.e., respondents only evaluate the frequency of a behavior if they indicated "yes" to the behavior).

In a study assessing 157 adults (86.6% female) in a multisite, randomized, controlled trial for BED, the following measures were compared to assess for the diagnosis of BED: EDE, QEWP-Revised (i.e., an earlier version of the QEWP-5; Spitzer, Yanovski, & Marcus, 1993), and BES (Celio, Wilfley, Crow, Mitchell, & Walsh, 2004). The EDE diagnosed 79% of individuals (n = 129) with BED, compared to 70.7% (n = 111) diagnosed with the QEWP-R, and 82.8% (n = 130) using the BES. Celio et al. (2004) used the EDE as the diagnostic standard for identifying binge eating and determined the QEWP-R had a sensitivity value of .74, and specificity of .35. Using the standard 27 cut point for serious binge eating, the BES had a sensitivity value of .85, and a specificity of .20.

In a gastric bypass surgery population (85% female; M_{age} = 39.5, SD = 9.3) low diagnostic concordance was found between the QEWP-R and the Structured Clinical Interview (SCID; First, Spitzer, Gibbon, & Williams, 1997; κ = .37). Fewer individuals met full BED diagnosis with the SCID than the QEWP-R (Dymek-Valentine, Rienecke-Hoste, & Alverdy, 2004).

The current study used the BES for severity of binge eating and the QEWP-5 to differentiate individuals who have BED and BN; specifically, they were used to distinguish between eating behaviors with and without compensatory responses. Unlike the BES, the QEWP-5 discerns differences between BED and BN diagnoses.

Exercise and Eating Disorders Questionnaire (EED). The Exercise and Eating Disorders Questionnaire (EED; Danielsen et al., 2012) is an 18-item measure that

assesses dimensions of compulsive and unhealthy exercise not evaluated in other measures related to exercise and eating disorders. The EED items were developed based on experience with female inpatients on an eating disorder unit. On the EED, respondents are asked to indicate the frequency of their eating and exercise behaviors and attitudes on a 6-point scale, from 0 (*never*) to 5 (*always*). Items are reversed-scored for statements with positive meaning. The EED is scored by totaling the values from each of the 18 items for the subscales and the global scale. Scores can range from 0 to 90. Higher scores indicate more compulsivity and unhealthy exercise. A recent factor analysis by the original authors revealed the EED contains four subscales: Compulsive Exercise, Positive and Healthy Exercise, Awareness of Bodily Signals, and Weight and Shape Exercise (Danielsen, BjØrnelv, & Rø, 2015; see Appendix G).

Danielsen et al.'s (2012) pilot study indicated the EED has good internal consistency (α = .92), and concurrent validity with the BAT (Body Attitude Test; Probst, 1997; Spearman's rho = .84). Global scores among female eating disorder patients were significantly, statistically different from healthy controls on the EED ($p < .001$). Eating disorder diagnoses were determined using criteria from the *DSM-IV TR (*American Psychiatric Association, 2000).

Recently, in a validation study of the EED, Danielsen et al. (2015) demonstrated that the four subscales of the EED have acceptable internal consistency: Compulsive Exercise (α = .93), Positive and Healthy Exercise (α = .84), Awareness of Bodily Signals (α = .83), and Weight and Shape Exercise (α = .87). Global scores were stable over a 7-day test-retest interval ($r = .86$), and subscales ranged from .68 to .90.

Patient Health Questionnaire (PHQ-9). The Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) is a nine-item section of the self-administered version of the Primary Care Evaluation of Mental Disorders (PRIME-MD;

Spitzer et al., 1994) that screens individuals for a probable depression diagnosis and assesses symptom severity. The PRIME-MD was the first instrument designed for use in primary care that diagnosed specific disorders using the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R*; American Psychiatric Association, 1987) and the *DSM-IV* (American Psychiatric Association, 1994). The PHQ-9 consists of the nine criteria used to diagnose DSM-IV depressive disorders.

Respondents are asked, "Over the last 2 weeks, how often have you been bothered by any of the following?" Items are scored on a 4-point scale from 0 (*not at all*) to 3 (*nearly every day*). There are no reverse scored items. Scores can range from 0 to 27, with higher scores reflecting higher levels of depression (scores ranging from 5 to 9 indicate mild depression, 10 to 14 indicate moderate depression, 15 to19 indicate moderately severe depression, and 20 to 27 indicate severe depression). Also, a cut-point of 10 or greater is considered a possible clinically significant condition and a cut-point of 15 or greater suggests active treatment is probably warranted.

Kroenke et al. (2001) found the PHQ-9 has excellent internal reliability (primary care sample, $\alpha = .89$, obstetrics-gynecology sample, $\alpha = .86$). Scores were stable over a 48-hour test-retest interval ($r = .84$), sensitivity for major depression was good (88%), and specificity for major depression was good (93%). In a sample of the general population in Germany, responses to the Brief Beck Depression Inventory (Brief-BDI; Schmitt, & Maes, 2000) were highly correlated with responses to the PHQ-9 ($r = .73$; Martin, Rief, Klaiberg, and Braehler, 2006).

The PHQ-9 was used to statistically control for depression in analyses because of the high mood disorder comorbidity rate for individuals with eating disorders (Grilo, White, & Masheb, 2009; see Appendix H).

Generalized Anxiety Disorder (GAD-7). The Generalized Anxiety Disorder (GAD-7; Spitzer, Kroenke, Williams, & Löwe, 2006) is a 7-item self-report measure that screens for potential cases of generalized anxiety disorder (GAD) and evaluates symptom severity. The GAD-7 items screen for the most prominent *DSM-IV* diagnostic indicators for GAD (American Psychological Association, 1994). Although primarily designed to assess for generalized anxiety disorder, the GAD-7 has been utilized to screen for other common anxiety disorders, such as panic disorder, social anxiety disorder, and post-traumatic stress disorder. Respondents are asked, "Over the last 2 weeks, how often have you been bothered by the following problems?" Items are scored on a 4-point scale, from 0 (*not at all*) to 3 (*nearly every day*). There are no reverse scored items. Scores range from 0 to 21, with higher scores reflecting higher levels of generalized anxiety (scores ranging from 5 to 9 indicate mild anxiety, 10 to 14 indicate moderate anxiety, 15 to 21 indicate severe anxiety). When screening for anxiety disorders, a recommended cut-point for clinically significant conditions is a score of 10 or greater.

According to Spitzer et al. (2006), the GAD-7 has excellent internal consistency (α =.92) and good test-retest reliability (ICC = 0.83) in a primary care setting. Additionally, the GAD-7 has strong convergent validity with the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988; r = 0.72) and the anxiety subscale of the Symptom Checklist-90 (Bjelland, Dahl, Haug, & Neckelmann, 2002; r = 0.74). Lowe, Decker, Muller, Brahler, Schellberg, Herzog, and Herzberg (2008) also found acceptable internal consistency for the GAD-7 (α = 0.89). Sensitivity assessing common anxiety disorders is good (α = .78-.95), and specificity for assessing GAD, panic disorder, social anxiety disorder, post-traumatic stress disorder, and any anxiety disorder using the GAD-7 is fair (α = .69-.76; Kroenke, Spitzer, Williams, Monahan, & Lowe, 2007).

The GAD-7 was included in order to statistically control for anxiety in analyses

because of the high anxiety disorder comorbidity rate for individuals with eating disorders (Grilo et al., 2009; see Appendix I).

The Emotional Eating Scale (EES). The Emotional Eating Scale (EES) is a 25-item self-report measure (Arnow, Kenardy, & Agras, 1995) used to assess emotional antecedents to binge eating. Each item on the questionnaire is an emotion word (e.g., excited, frustrated, guilty) and respondents are asked, "Please indicate the extent to which the following feelings lead you to feel an urge to eat," from 0 (*No desire to eat*) to 4 (*An overwhelming urge to eat*). The three subscales on the EES include: Anger/Frustration (i.e., eating in response to anger), Anxiety (i.e., eating in response to anxiety), and Depression (i.e., eating in response to depressed mood). Higher scores indicate higher psychopathology. Arnow et al. (1995) suggests using on the subscales on the EES, rather than evaluating a global composite score (see Appendix J).

Arnow et al. (1995) administered the EES to 47 obese treatment-seeking females diagnosed with bulimia nervosa. Each subscale had adequate internal consistency: Anger/Frustration ($\alpha = .78$), Anxiety ($\alpha = .78$), and Depression ($\alpha = .72$). Convergent validity was also found between the EES and the BES, such that high levels on the BES correlated with all three subscales on the EES: Anger/Frustration ($r = .65$, $p < .001$), Anxiety ($r = .50$, $p < .001$), and Depression ($r = .46$, $p < .001$). Discriminant validity was assessed between the EES (a measure of emotion regulation through eating) and the Symptom Checklist-90 (a measure of psychological adjustment); adequate discriminant validity was found for all three subscales: Anger/Frustration ($r = .24$, $p > .05$), Anxiety ($r = .18$, $p > .05$), and Depression ($r = .17$, $p > .05$).

In a non-clinical sample of 51 women (i.e., no current or past eating disorders), the EES showed a high level of internal consistency: Anger/Frustration ($\alpha = .87$), Anxiety ($\alpha = .84$), and Depression ($\alpha = .80$), as well as convergent validity with the Eating

Disorders Inventory-2 (EDI-2; Garner, 1991). Each of the subscales on the EES were significantly related the bulimia subscale on the EDI-2: Anger/Frustration ($r = .49$, $p < .001$), Anxiety ($r = .35$, $p < .01$), and Depression ($r = .49$, $p < .001$; Waller & Osman, 1998).

Because the current study hypothesized that mood-related exercise motives account for a significant proportion of the variance in disordered eating outcomes, and it is known that there are emotional precursors to binge eating, it was important to determine what, if any, proportion of the variance in disordered eating outcomes is accounted for by emotional eating. Therefore, the EES was used in analyses with the REI Stress/Mood Management subscale.

Procedures

Participants were recruited from undergraduate psychology courses through the SONA research system, which automated the record-keeping process for students who participated in research. Participants were invited to complete a web-based survey examining exercise and eating behavior. The survey was designed and hosted using SurveyMonkey (www.SurveyMonkey.com), which is an internet-based vendor used for deploying surveys. Because data collection occurred online, a detailed description of the survey was provided, and informed consent was inferred through continuation with the survey upon reading an information page. This contained all standard elements of informed consent (see Appendix K).

Students were eligible to receive extra credit in their psychology course from their professors or laboratory instructors for their participation in the survey in accordance with the course polices. There were no exclusion criteria to complete the online survey, except that participants had to be at least 18 years of age (to provide independent informed consent). However, some participants were excluded from the analyses. At the end of the

survey, if students wanted to receive extra credit in their psychology course for their participation in the study, they clicked on a link to a separate web page where they provided their name and professor's name. This information was kept separate from their data. Students were awarded extra credit in accordance with their course policies.

Participants were able to complete the survey in one session, and they were able to do so from any computer with internet access. All participants received the same set of questionnaires. Participants were first asked to complete a demographics questionnaire. This was then followed by the Global Physical Activity Questionnaire (GPAQ), the Reasons for Exercise Inventory (REI), the Eating Disorder Examination Questionnaire (EDE-Q), the Binge Eating Scale (BES), the Questionnaire on Eating and Weight Patterns-5 (QEWP-5), the PHQ-9, the GAD-7, the Emotional Eating Scale (EES), and then the Exercise and Eating Disorders Questionnaire (EED). Once all of the measures were completed, participants were then directed to the separate survey to provide their information for extra credit. Participants were able to complete the survey in approximately 30–45 minutes. At the end of the survey, participants were asked if they wanted to provide additional contact information to participate in future research.

A follow-up study was conducted to further analyze the psychometric properties of the EED. Data collection is ongoing, and includes the following questionnaires: REI, EDE-Q, EED, PHQ-9, and GAD-7. Results from the follow-up study are not a formal part of the thesis results. The study procedure was approved by the university's institutional review board (IRB; see appendix L).

Data Analyses

Preliminary Analyses

Data analyses were conducted using SPSS version 24 statistical software. Descriptive analyses were conducted on all variables of interest. Evidence of significant

skew and kurtosis was identified for the GPAQ; thus, a log-10 transformation was performed (Tabachnick & Fidell, 2013; see Table 1). Accordingly, all subsequent analyses were conducted twice; once using raw GPAQ scores and once using log-10 transformed GPAQ scores. Due to evidence of non-linearity and heteroscedasticity found in analyses with raw GPAQ scores, results are presented using the transformed GPAQ scores only. All multivariate assumptions were met with analyses run with transformed GPAQ scores. No additional evidence of non-normality was found; therefore, no other variables were transformed.

Table 1.

Raw and Transformed GPAQ MET Scores (*N* = 482)

Condition	*M* (*SD*)	Skewness (SE)	Kurtosis (SE)	Minimum	Maximum
GPAQ Physical Activity	5302.32 (6153.11)	2.07 (.11)	4.93 (.22)	.00	34160.00
LG10 GPAQ Physical Activity	3.19 (1.15)	-2.00 (.11)	3.03 (.22)	.00	4.55

Note. Participants only endorsed physical activity behavior if they engaged in at least 10 minutes of activity. GPAQ total scores are commonly described as METs (Metabolic Equivalents). GPAQ total scores are converted to METS by calculating a person's overall energy expenditure (i.e., a percentage). 4 METS are equivalent to moderate-level physical activity, and 8 METS is equivalent to vigorous-level physical activity. Participants engaged in both moderate- and vigorous-level physical activity.

After data cleaning, a valid sample included 1,010 participants. Respondents who reported a current pregnancy were excluded from subsequent analyses (N = 15) because pregnancy significantly impacts body weight and eating behavior. Additionally, participants who reported any physical disabilities or medical conditions that limited their involvement in physical activity were excluded from analyses (N = 194) because this alters participation in exercise. Thus, individuals who endorsed a physical disability did not complete any physical activity-related measures, including the following: REI, GPAQ, and EED. Preliminary analyses were conducted with a final sample of 771 participants (see Figure 1). Some analyses had a smaller final sample size (N = 482) because of the GPAQ list-wise deletion.

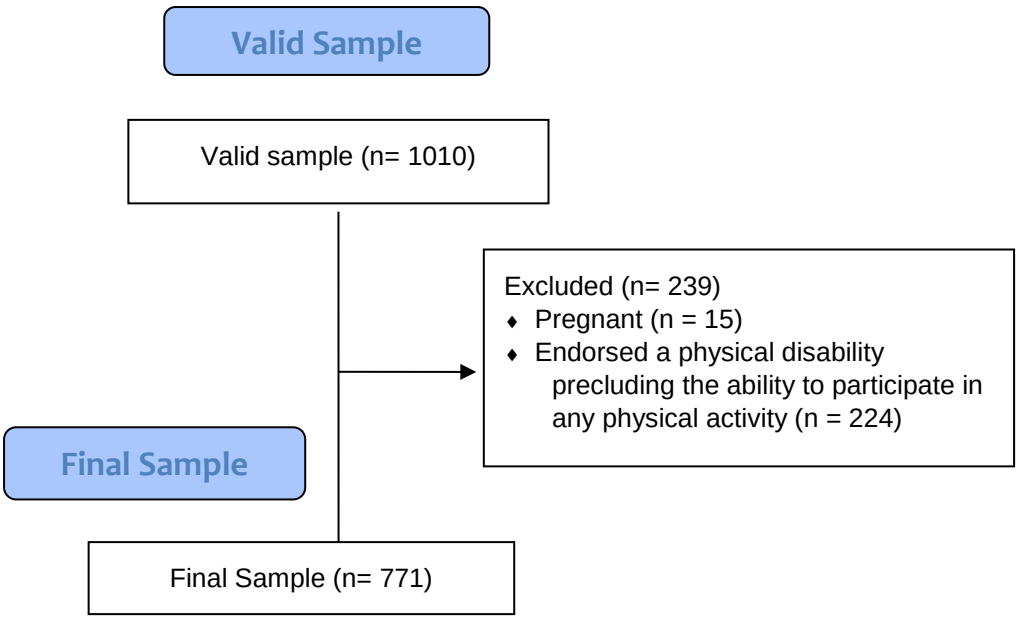

Figure 1. Primary analyses.

To assess if data were missing at random, missing data was inspected using the SPSS 24 missing value analysis (MVA) program. From the final sample analyzed, only the GPAQ had missingness greater than 5%. Specifically, 289 participants had missing

data for the GPAQ, which was beyond the other missing cases excluded by design. According to the MVA program, no clear pattern emerged to explain the missingness.

Recently, our lab found a similarly high level of missing data in another study using the IPAQ. The GPAQ and the IPAQ were both originally developed to be used as telephone exercise screeners, rather than online survey questionnaires. It is possible that the altered format made it difficult for some respondents to know how to provide answers. Therefore, list-wise deletion was used in analyses with the GPAQ. Cases were deleted list-wise from analyses if they had any missing data from the other variables of interest as well.

A basic qualitative analysis suggested that of the 224 participants who endorsed a physical disability or medical condition precluding the ability to participate in any physical activity, 82.5% (n = 146) of them endorsed a chronic physical disability/medical condition, 14.1% (n = 25) reported an acute physical disability/medical condition, 2.8% (n = 5) indicated they currently had a psychiatric disability, and the remaining 0.6% (n = 1) endorsed a comorbid chronic physical disability/medical condition and a psychiatric disability.

A majority of the sample analyzed (N = 771) did not met the cut-point for binge eating severity according to the BES (see Table 2). Interestingly, none of the participants met full-criteria for either binge eating disorder (BED) or bulimia nervosa (BN) on the QEWP-5. However, about 9.3% (n = 72) of participants did endorse sub-threshold binge eating (i.e., binge eating behavior and loss of control during episodes of binge eating) on the QEWP-5, so it is possible that the BES and QEWP-5 measure something qualitatively different.

Table 2.

Binge Eating Scale (BES) Categories (*N* = 771)

Category	Frequency	Percent
No Binge Eating	620	80.4
Moderate Binge Eating	118	15.3
Severe Binge Eating	33	4.3

Over half of the sample endorsed at least mild depression on the PHQ-9 (see Table 3).

Table 3.

Depression (PHQ-9) Categories (*N* = 771)

Category	Frequency	Percent
No Depression	346	44.9
Mild Depression	225	29.2
Moderate Depression	120	15.6
Moderately Severe Depression	54	7.0
Severe Depression	26	3.4

Similarly, about half of the sample indicated they had at least mild anxiety on the GAD-7 (see Table 4).

Table 4.

Anxiety (GAD-7) Categories (*N* = 771)

Category	Frequency	Percent
No Anxiety	375	48.6
Mild Anxiety	213	27.6
Moderate Anxiety	113	14.7
Severe Anxiety	70	9.1

Participants reported how physically active they were each week. For ease of interpretation, a dichotomous variable was created (i.e., WHO Physical Activity Recommendations) to determine if participants met the minimum amount of physical activity recommended by World Health Organization. Specifically, the WHO recommends that individuals engage in at least 30 minutes of moderate to intense physical activity at least 5 days a week, or 20 minutes of vigorously intense physical activity for 3 days each week (Haskell et al., 2007). This conceptualization of the total amount of physical activity participants engaged in per week (i.e., minutes/week) was supported by the GPAQ manual. To simplify the results, the raw GPAQ Physical Activity MET scores were used to calculate whether participants did or did not meet recommendations for the minimum amount of physical activity suggested per week (see Table 5). Most participants met this minimum amount of physical activity threshold.

Table 5.

WHO Physical Activity Recommendations Categories (*N* = 482)

Category	Frequency	Percent
Did Not Meet Minimum Amount of Physical Activity per week	79	16.4
Met Minimum Amount of Physical Activity per week	403	83.6

Primary Analyses

Hypothesis One. As expected, exercise motives were significantly associated with disordered eating outcomes (see Table 6). Because there were significant Pearson's *r* correlations between exercise motives and disordered eating measures, standard multiple regression analyses were then conducted. Due to multicollinearity (i.e., Pearson's $r \geq .7$), REI subscales were not entered simultaneously; they were tested in independent models. REI Fitness/Health Management subscale ($F(1, 716) = 11.37$, $p = .001$, $r^2 = .016$) and REI Appearance/Weight Management subscale ($F(1, 716) = 63.99$, $p < .001$, $r^2 = .082$) explained a significant proportion of variance in the EDE-Q global score. REI Socializing subscale was a nonsignificant predictor of EDE-Q global score, $F(1, 716) = .11$, $p = .74$, $r^2 = .013$.

Table 6.

Bivariate Correlation Matrix of Exercise Motives and Disordered Eating Measures (*N* = 771)

Variables	1	2	3	4	5	6	7	8	9	10
1. REI Fitness/Health Management subscale	–									
2. REI Appearance/Weight Management subscale	.91***	–								
3. REI Stress/Mood Management subscale	.90***	.84***	–							
4. REI Socializing subscale	.73***	.70***	.75***	–						
5. EDE-Q global score	.13**	.29***	.13**	.01	–					
6. EDE-Q Restraint subscale	.24***	.34***	.20***	.11**	.74***	–				
7. EDE-Q Eating Concern subscale	.06	.19***	.09*	.06	.79***	.57***	–			
8. EDE-Q Shape Concern subscale	.08*	.23***	.08*	-.02	.95***	.57***	.67***	–		
9. EDE-Q Weight Concern subscale	.05	.21***	.06	-.02	.94***	.57***	.70***	.92***	–	
10. BES composite score	-.01	.12**	.03	-.03	.65***	.38***	.68***	.65***	.64***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

REI Stress/Mood Management subscale analyses were conducted on an exploratory basis due to the known association between emotion regulation and binge eating behavior. First, a correlation matrix was inspected to examine basic bivariate associations between the REI Stress/Mood Management subscale, the EES, and disordered eating outcomes (see Table 7).

Because there were significant Pearson's *r* correlations between the REI Stress/Mood Management subscale, the EES, and EDE-Q global score, mediation multiple regression analyses were conducted. Due to multicollinearity (i.e., Pearson's $r > .7$), EES subscales were not entered simultaneously; they were tested in independent models.

Table 7.

Bivariate Correlation Matrix of Exercise Motives, Emotional Eating, and Disordered Eating Measures (*N* = 771)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. REI Stress/Mood Management subscale	–										
2. EES global score	.08*	–									
3. EES Anger/Frustration subscale	.07	.96***	–								
4. EES Anxiety subscale	.07	.95***	.87***	–							
5. EES Depression subscale	.08*	.86***	.72***	.73***	–						
6. EDE-Q global score	.13**	.33***	.30***	.29***	.35***	–					
7. EDE-Q Restraint subscale	.20***	.18***	.17***	.15***	.18***	.74***	–				
8. EDE-Q Eating Concern subscale	.09*	.45***	.43***	.41***	.39***	.79***	.57***	–			
9. EDE-Q Shape Concern subscale	.08*	.31***	.27***	.27***	.35***	.95***	.57***	.67***	–		
10. EDE-Q Weight Concern subscale	.06	.33***	.28***	.28***	.34***	.94***	.57***	.70***	.92***	–	
11. BES composite score	.03	.48***	.44***	.42***	.48***	.65***	.38***	.68***	.65***	.64***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

A multiple regression mediation analysis was conducted, with the EES global score as the mediator. The relationship between REI Stress/Mood Management subscale and EDE-Q global score was partially mediated by EES global score (see Figure 2). Analyses conducted with the EES Anger/Frustration subscale, EES Anxiety subscale, and EES Depression subscale yielded a similar pattern of results.

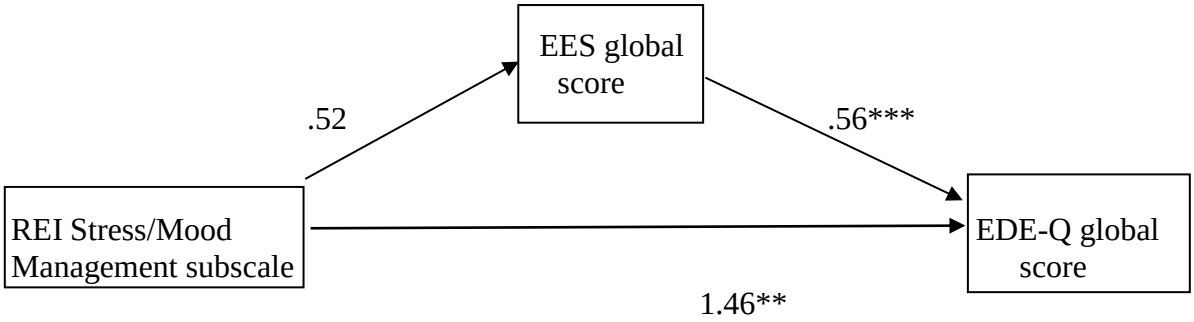

Figure 2. Path analysis of the relationship between REI Stress/Mood Management subscale and EES global score, and EDE-Q global score. Values presented are unstandardized coefficients. *p < .05 **p < .01 ***p < .001.

Likewise, comparable analyses using EDE-Q Restraint subscale, EDE-Q Eating Concern subscale, EDE-Q Shape Concern subscale, and EDE-Q Weight Concern subscale as outcomes resulted in similar findings.

Using the BES as the disordered eating outcome, the REI Appearance/Weight Management subscale again explained a significant proportion of the variance ($F(1, 769) = 12.05$, $p = .001$, $r^2 = .015$), but the REI Fitness/Health Management subscale ($F(1, 769) = .11$, $p = .74$, $r^2 < .001$) and REI Socializing subscale did not ($F(1, 769) = .53$, $p = .47$, $r^2 = .001$).

Similar to the EDE-Q analyses, the association between REI Stress/Mood Management subscale and BES composite score was analyzed on an exploratory basis.

The relationship between REI Stress/Mood Management subscale and BES composite score was fully mediated by EES global score (see Figure 3).

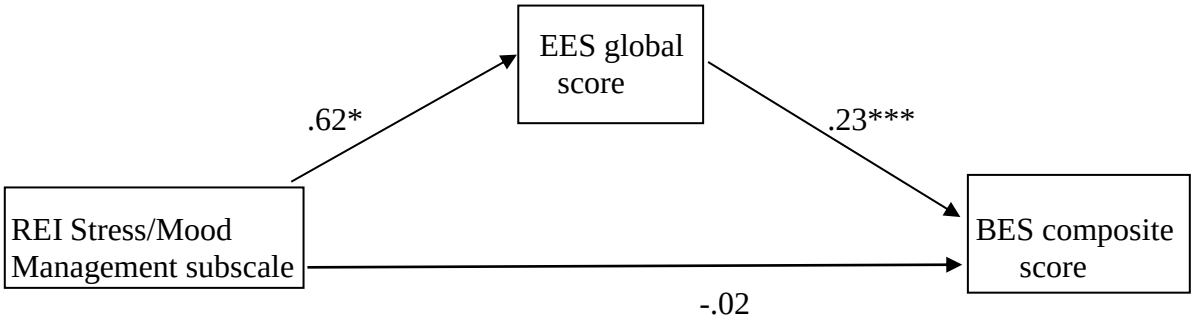

Figure 3. Path analysis of the relationship between REI Stress/Mood Management subscale and EES global score, and BES composite score. Values presented are unstandardized coefficients. *p < .05 **p < .01 ***p < .001.

Hypothesis Two. As expected, the associations between physical activity behavior and disordered eating outcomes were generally weak and non-significant (see Table 8).

Table 8.

Bivariate Correlation Matrix of Physical Activity and Disordered Eating Measures (*N* = 482)

Variables	1	2	3	4	5	6	7
1. LG 10 GPAQ Physical Activity	–						
2. EDE-Q global score	.05	–					
3. EDE-Q Restraint subscale	.14**	.74***	–				
4. EDE-Q Eating Concern subscale	.01	.79***	.57***	–			
5. EDE-Q Shape Concern subscale	.01	.95***	.57***	.67***	–		
6. EDE-Q Weight Concern subscale	.04	.94***	.57***	.70***	.92***	–	
7. BES composite score	.03	.65***	.38***	.67***	.65***	.64***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Hypothesis Three. It was expected that physical activity behavior would moderate the relationship between exercise motives and disordered eating, such that certain exercise motives (e.g., REI Appearance/Weight Management subscale) would be associated with higher scores on disordered eating among individuals who exercise more, whereas other exercise motives (e.g., REI Fitness/Health Management subscale) would not demonstrate the same relationship. Earlier analyses supporting hypothesis one that exercise motives explained a significant proportion of the variance in disordered eating outcomes provided support for this exploration of potential moderators of the relationship. First, this was analyzed by producing a correlation matrix and examining basic bivariate associations (see Table 9).

Table 9.

Bivariate Correlation Matrix of Exercise Motives, Physical Activity, and Disordered Eating Measures (*N* = 482)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. REI Fitness/Health Management subscale	–										
2. REI Appearance/Weight Management subscale	.91***	–									
3. REI Stress/Mood Management subscale	.90***	.84***	–								
4. REI Socializing subscale	.73***	.67***	.75***	–							
5. LG 10 GPAQ Physical Activity	.34***	.30***	.32***	.26***	–						
6. EDE-Q global score	.13**	.29***	.13**	.01	.05	–					
7. EDE-Q Restraint subscale	.24***	.34***	.20***	.11**	.14**	.74***	–				
8. EDE-Q Eating Concern subscale	.06	.19***	.09	.06	.01	.79***	.57***	–			
9. EDE-Q Shape Concern subscale	.08*	.23***	.08*	-.02	.01	.95***	.57***	.67***	–		
10. EDE-Q Weight Concern subscale	.05	.21***	.06	-.02	.04	.94***	.57***	.70***	.92***	–	
11. BES composite score	-.01	.12**	.03	-.03	.03	.65***	.38***	.67***	.67***	.64***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Because there were significant Pearson's *r* correlations between the exercise motives, physical activity behavior, and disordered eating, multiple regression analyses were subsequently considered as the next step in analysis, using the bootstrapping approach (Preacher & Hayes, 2004; see Tables 10–12). In the moderated multiple regression analyses, exercise motive was the independent variable, physical activity behavior was the moderator, and disordered eating was the outcome variable (see Figures 5–6). Analyses were conducted using the Hayes (2013) Process macro. Tables 10–16 and Figures 4–6 display the unstandardized regression coefficients (*b),* confidence intervals with bootstrap of 5000 (CI95%), and adjusted R^2.

Table 10.

Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship Between REI Fitness/Health Management subscale and EDE-Q global score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Fitness/Health Management subscale	6.30*	2.56	2.46	[1.27, 11.33]
LG 10 GPAQ Physical Activity	2.03	1.88	1.08	[-1.67, 5.74]
REI Fitness/Health Management subscale x LG 10 GPAQ Physical Activity	-1.21	.72	-1.69	[-2.62, .20]
Adjusted R^2 = .032, $F(3, 447) = 4.96$, $p = .002$.				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 11.

Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship Between REI Appearance/Weight Management subscale and EDE-Q global score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Appearance/Weight Management subscale	5.84*	2.55	2.29	[.82, 10.86]
LG 10 GPAQ Physical Activity	-.10	1.83	-.06	[-3.70, 3.49]
REI Appearance/Weight Management subscale x LG 10 GPAQ Physical Activity	-.55	.72	-.76	[-1.97, .88]
Adjusted R^2 = .079, $F(3, 447) = 12.70$, $p < .001$				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 12.

Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship Between REI Socializing subscale and EDE-Q global score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Socializing subscale	8.88*	3.60	2.47	[1.81, 15.95]
LG 10 GPAQ Physical Activity	4.99*	2.01	2.48	[1.04, 8.95]
REI Socializing subscale x LG 10 GPAQ Physical Activity	-2.47*	1.00	-2.47	[-4.43, -.51]
Adjusted R^2 = .016, $F(3, 447) = 2.39$, $p = .07$				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .05$, ** $p < .01$, *** $p < .001$.

Simple slopes analysis was conducted in order to probe the interaction effect. At low levels of LG 10 GPAQ Physical Activity (-1 *SD*), the relation between REI Socializing subscale and EDE-Q Global score was significant, b = .1.67, 95% CI [.47, 7.03], t = 2.25, p = .03 (see Figure 4). At average levels of LG 10 GPAQ Physical Activity (sample mean), REI Socializing subscale was nonsignificantly associated with average EDE-Q global scores, b = .93, 95% CI [-.86, 2.79], t = 1.04, p = .30. At high levels of LG 10 GPAQ Physical Activity (+1 *SD*), REI Socializing subscale and EDE-Q global score were also nonsignificantly associated, b = -1.82, 95% CI [-4.22, .57], t = -1.50, p = .14.

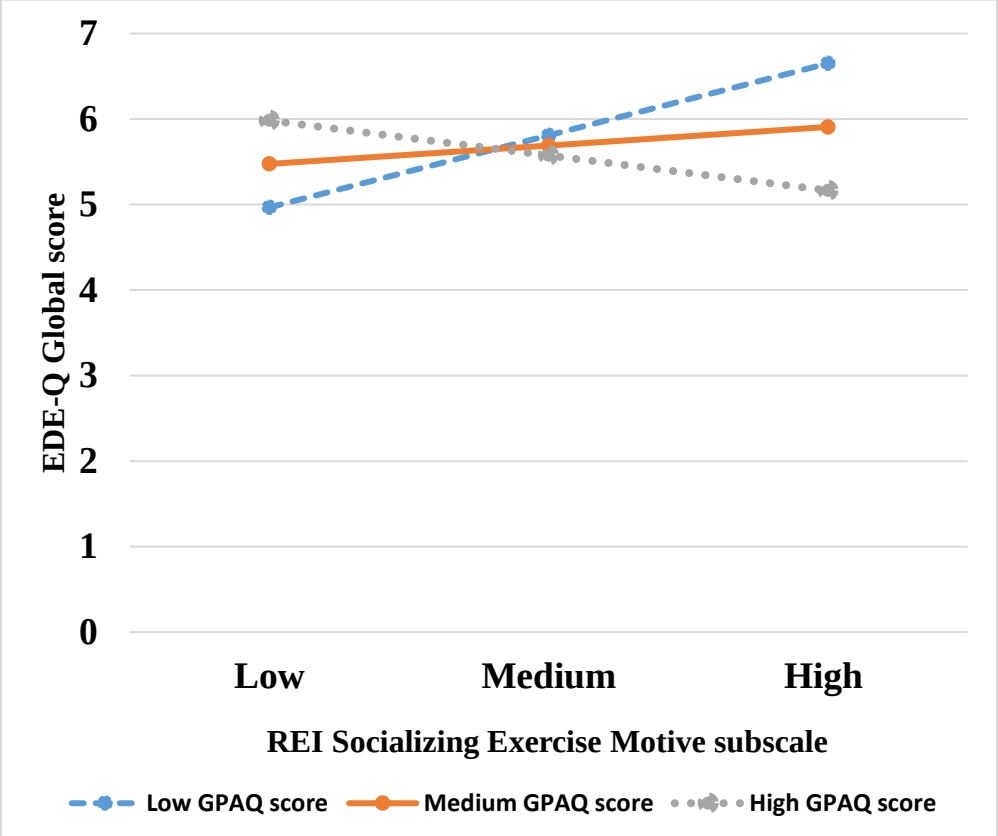

Figure 4. Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship between REI Socializing subscale and EDE-Q global score.

Moderated multiple regression analyses with REI Stress/Mood Management subscale were analyzed on an exploratory basis due to the known association between emotion regulation and binge eating behavior. First, a correlation matrix was conducted to examine basic bivariate associations between the REI Stress/Mood Management subscale, LG 10 GPAQ Physical Activity, EES global score, and EDE-Q global score (see Table 13).

Table 13.

Bivariate Correlation Matrix of Exercise Motives, Emotional Eating, Physical Activity, and Disordered Eating Measures (*N* = 482)

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. REI Stress/Mood Management subscale	–											
2. LG 10 GPAQ Physical Activity	.32***	–										
3. EES global score	.08*	.01	–									
4. EES Anger/Frustration subscale	.07	-.01	.96***	–								
5. EES Anxiety subscale	.07	.01	.95***	.87***	–							
6. EES Depression subscale	.08*	.01	.86***	.72***	.73***	–						
7. EDE-Q global score	.13**	.05	.33***	.30***	.29***	.35***	–					
8. EDE-Q Restraint subscale	.20***	.14**	.18***	.17***	.15***	.18***	.74***	–				
9. EDE-Q Eating Concern subscale	.09*	.01	.45***	.43***	.41***	.39***	.79***	.57***	–			
10. EDE-Q Shape Concern subscale	.08*	.01	.31***	.27***	.27***	.35***	.95***	.57***	.67***	–		
11. EDE-Q Weight Concern subscale	.06	.04	.33***	.29***	.28***	.34***	.94***	.57***	.70***	.92***	–	
12. BES composite score	.03	.03	.48***	.44***	.42***	.48***	.65***	.38***	.68***	.65***	.65***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Because there were significant Pearson's *r* correlations between the variables of interest, a moderated mediation multiple regression analysis was conducted. The LG 10 GPAQ Physical Activity was the moderator and the EES global score was the mediator used to explore the impact of physical activity behavior on the previous mediated multiple regression. The relationship between REI Stress/Mood Management subscale and EDE-Q global score was partially mediated by EES global score (see Figure 5). LG 10 GPAQ Physical Activity moderated the relationship between REI Stress/Mood Management subscale and EDE-Q global score (see Figure 5), such that only at low or medium levels of physical activity, REI Stress/Mood Management subscale accounted for a significant proportion of the variance in EDE-Q global scores.

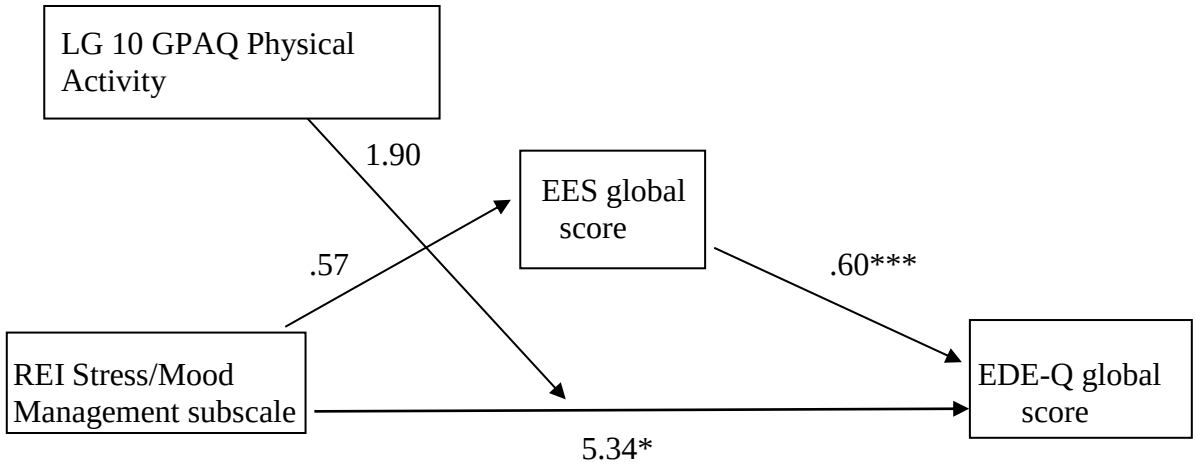

Figure 5. Path analysis of the relationship between REI Stress/Mood Management subscale and EES global score, and EDE-Q global score, moderated by LG 10 GPAQ Physical Activity. Values presented are unstandardized coefficients. *p < .05 **p < .01 ***p < .001.

Moderated mediation multiple regression analyses conducted with the EES Anger/Frustration subscale, EES Anxiety subscale, and EES Depression subscale substituted for the EES global score yielded a similar pattern of results.

Regression analyses substituting the EDE-Q Restraint subscale, EDE-Q Eating Concern subscale, EDE-Q Shape Concern subscale, and EDE-Q Weight Concern subscale for the EDE global score resulted in similar findings; likewise, substituting REI Fitness/Health Management subscale, REI Appearance/Weight Management subscale, and REI Socializing subscales for Stress/Mood management yielded a similar pattern.

Because there were significant Pearson's *r* correlations between exercise motives, emotional eating, physical activity, and BES composite score (see Table 13), additional multiple regression analysis were conducted (see Tables 14–16).

Table 14.

Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship Between REI Appearance/Weight Management subscale and BES composite score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Fitness/Health Management	.44	.63	.69	[-.81, 1.68]
LG 10 GPAQ Physical Activity	.40	.50	.80	[-.58, 1.39]
REI Fitness/Health Management x LG 10 GPAQ Physical Activity	-.11	.18	.55	[-.46, .24]
Adjusted R^2 = .002, $F(3, 478)$ = .35, p = .79				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .01$, *** $p < .001$.

Table 15.

Moderation Effect of LG 10 GPAQ Physical Activity on the Relationship Between REI Appearance/Weight Management subscale and BES composite score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Appearance/Weight Management	.71	.65	1.09	[-.57, 1.99]
LG 10 GPAQ Physical Activity	-.03	.49	-.06	[-1.00, .94]
REI Appearance/Weight Management x GPAQ Physical Activity	-.03	.19	-.18	[-.40, .33]
Adjusted R^2 = .023, $F(3, 478) = 3.79$, $p = .011$				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .01$, *** $p < .001$.

Table 16.

Moderation Effect of LG 10 GPAQ Physical Activity Total minutes/week on the Relationship Between REI Socializing subscale and BES composite score

Variable	*b*	SE(*b*)	*t*	$CI_{95\%}$ for *b*
REI Socializing subscale	.29	.82	.35	[-1.33, 1.91]
LG 10 GPAQ Physical Activity	.39	.51	.76	[-.62, 1.40]
REI Socializing subscale x LG 10 GPAQ Physical Activity	-.09	.23	-.39	[-.55, .36]
Adjusted R^2 = .001, $F(3, 478)$ = .23, p = .88				

Note. $CI_{95\%}$ = 95% confidence intervals with bootstrap of 5000, * $p < .01$, *** $p < .001$.

Similar to the EDE-Q analyses, analyses with BES composite score as an outcome and REI Stress/Mood Management subscale as the predictor were analyzed on an exploratory basis due to the known association between emotion regulation and binge eating behavior. A moderated mediation multiple regression analysis was conducted, with the LG 10 GPAQ Physical Activity as the moderator, and the EES global score as the mediator, on the relationship between REI Stress/Mood Management subscale and BES composite score. The relationship between REI Stress/Mood Management subscale and BES composite score was partially mediated by EES global score (see Figure 6). LG 10 GPAQ Physical Activity did not significantly moderate the relationship between REI Stress/Mood Management subscale and BES composite score (see Figure 6).

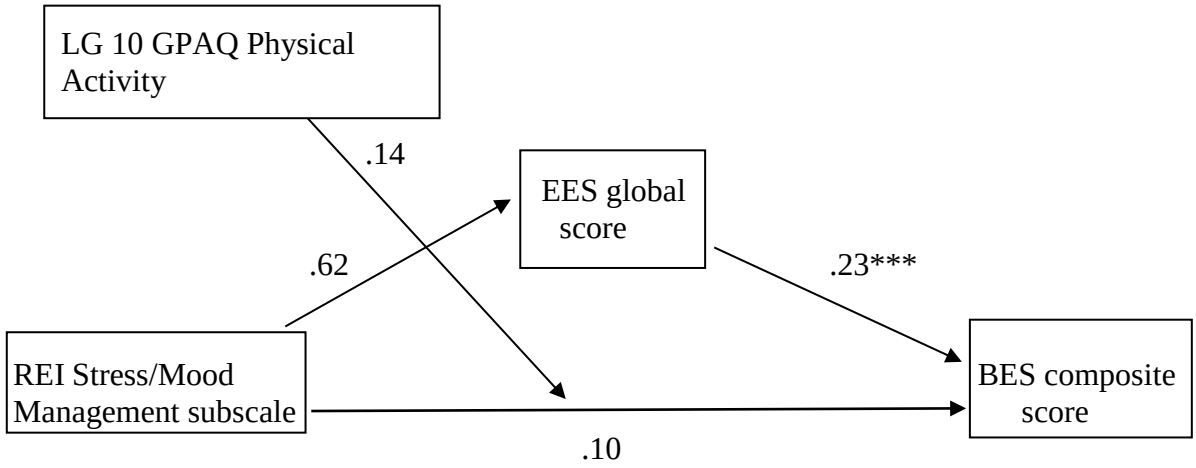

Figure 6. Path analysis of the relationship between REI Stress/Mood Management subscale and EES global score, and BES composite score, moderated by LG 10 GPAQ Physical Activity. Values presented are unstandardized coefficients. *p < .05 **p < .01 ***p < .001.

Moderated mediation multiple regression analyses conducted with the EES Anger/Frustration subscale, EES Anxiety subscale, and EES Depression subscale had similar results.

Hypothesis Four. It was expected that sport type would be associated with disordered eating. The final sample analyzed for this hypothesis was 87 participants (see Figure 7). The group of sport athletes were collapsed from the following activities: NCAA sports (*n* = 25), intramural/club sports (*n* = 45), and community sports (*n* = 17). This was based on the pilot study: Athletes in Lean vs. Non-lean Sports.

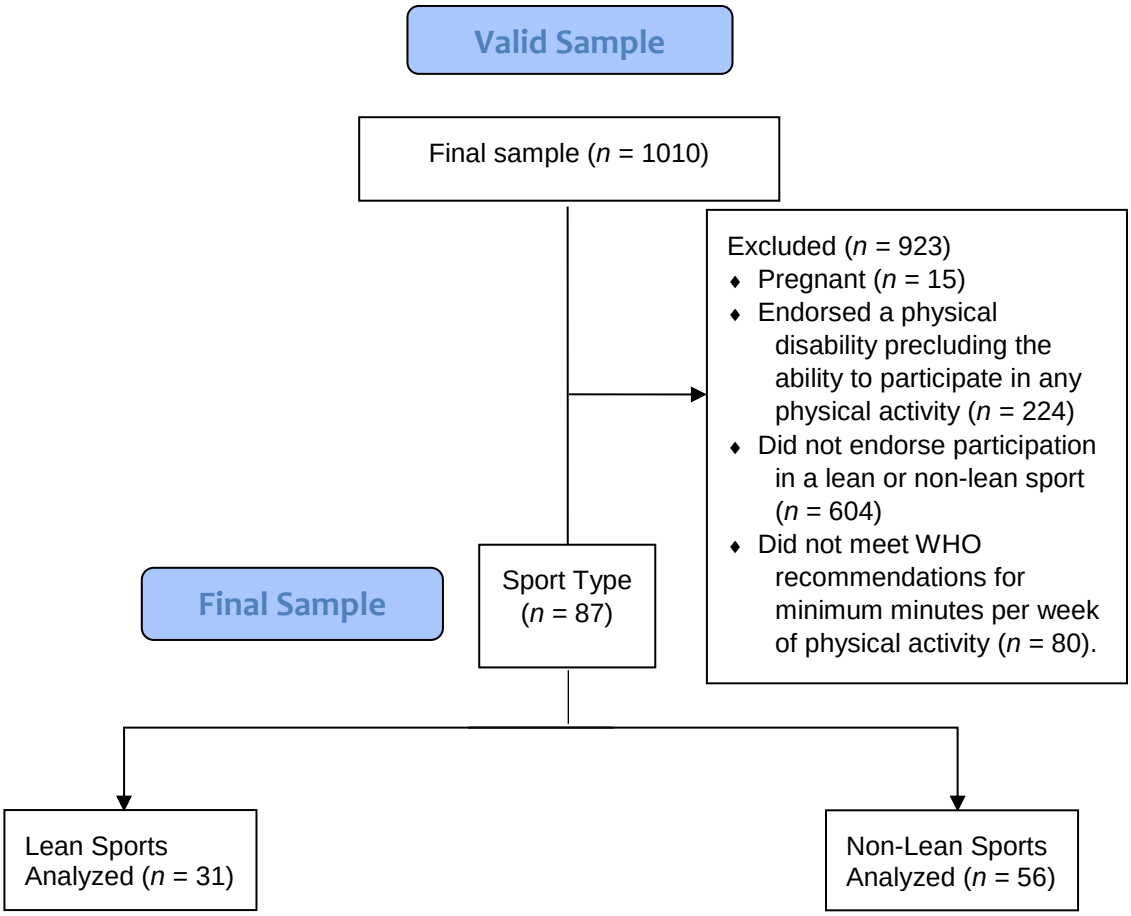

Figure 7. Lean and non-lean sport analyses.

Independent-samples *t*-tests were conducted to compare lean and non-lean sport players on measures of disordered eating (see Table 17). Independent-samples t-tests revealed no statistically significant difference between lean and non-lean sport groups on EDE-Q global score, ($t(80) = .13$, $p = .90$, 95% CI [-12.86, 14.60]), EDE-Q Restraint subscale ($t(84) = .26$, $p = .80$, 95% CI [-.56, .72]), EDE-Q Eating Concern subscale ($t(83) = .14$, $p = .89$, 95% CI [-.49, .56]), EDE-Q Shape Concern subscale ($t(83) = -.20$, $p = .84$,

95% CI [-.85, .69]), EDE-Q Weight Concern subscale ($t(82) = -.38$, $p = .71$, 95% CI [-.91, .62]), or BES composite score ($t(85) = 1.0$, $p = .30$, 95% CI [-1.91, 6.05]).

Table 17.

Lean and Non-Lean Sport Group Descriptives by Disordered Eating Outcomes

Variable	*N*	EDE-Q global score *M* (*SD*)	EDE-Q Restraint subscale *M* (*SD*)	EDE-Q Eating Concern subscale *M* (*SD*)	EDE-Q Shape Concern subscale *M* (*SD*)	EDE-Q Weight Concern subscale *M* (*SD*)	BES composite score *M* (*SD*)
Lean sports	31	35.06 (28.91)	1.64 (1.31)	1.06 (1.24)	1.89 (1.61)	1.50 (1.70)	11.52 (9.55)
Non-Lean sports	56	34.20 (31.08)	1.56 (1.50)	1.02 (1.13)	1.97 (1.77)	1.65 (1.69)	9.458.60)

Hypothesis Five. It was expected that exercise motives would moderate the relationship between sport type and measures of disordered eating. Because no significant relationships were found between sport type and measures of disordered eating, the data do not support this assertion, and no additional analyses were conducted to test this hypothesis.

Hypothesis Six. It was expected that exercise motives and physical activity behavior would moderate the relationship between type of sport and disordered eating. However, since no significant relationships were found between sport type and measures of disordered eating, the data do not support this assertion, and again, no additional analyses were conducted to test this hypothesis

Hypothesis Seven. As expected, good convergent validity between the EED and the EDE-Q, as well as the EED and the REI was found (see Table 18).

Table 18.

Bivariate Correlation Matrix of Exercise and Eating Disorders Questionnaire (*N* = 743)

Variables	1	2	3	4	5	6
1. EED Weight and Shape Related Exercise subscale	–					
2. EED Positive and Healthy Exercise subscale	.29***	–				
3. EDE-Q Shape Concern subscale	.56***	-.08*	–			
4. EDE-Q Weight Concern subscale	.53***	-.11**	.92***	–		
5. REI Fitness/Health Management subscale	.29***	.56***	.08*	.05	–	
6. REI Appearance/Weight Management subscale	.46***	.46***	.23***	.21***	.91***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Significant, positive Pearson's *r* correlations between the EED Weight and Shape Related Exercise subscale and the EDE-Q Shape Concern subscale were found (see Table 18), suggesting that good convergent validity exists between the two measures. Notably, however, the measures were not perfectly correlated, suggesting some measure of divergent validity, as well. Similarly, significant, positive Pearson's *r* correlations were found between the EED Weight and Shape Related Exercise subscale and the EDE-Q Weight Concern subscale was found (see Table 18). Additionally, good convergent validity was found between the EED Positive and Healthy Exercise subscale and the REI Fitness/Health Management subscale (see Table 18). Likewise, significant, positive Pearson's *r* correlations was found between the EED Weight and Shape Related Exercise subscale and the REI Appearance/Weight Management subscale (see Table 18).

Hypothesis Eight. Due to the significant but not entirely overlapping convergent validity found between certain subscales on the EED and REI, it was expected that the EED could account for additional variance, after controlling for the REI, when predicting disordered eating outcomes. Therefore, the EED Positive and Healthy Exercise subscale and the EED Weight and Shape Related Exercise subscale were focused on specifically because analyses from hypothesis seven provided support for the relationships (see Tables 19–22). Importantly, the EDE-Q Shape Concern and Weight Concern subscales were used cautiously because it was understood that they likely reported similar information to the EED Weight and Shape Related Exercise subscale. However, other disordered eating outcomes were regarded as important to analyze.

Table 19.

Summary of Hierarchical Regression Analysis for Variables Predicting EDE-Q global score (*N* = 771)

Variables	Model 1			Model 2		
	b	SE(*b*)	t	*b*	SE(*b*)	t
REI Appearance/Weight Management subscale	3.98***	.50	7.91	.29	.48	.60
EED Weight and Shape Related Exercise subscale				11.29***	.68	16.70
R^2	.081			.34		
F for change in R^2	62.54***			278.95***		

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 20.

Summary of Hierarchical Regression Analysis for Variables Predicting BES composite score (*N* = 771)

Variables	Model 1			Model 2		
	b	SE(*b*)	t	*b*	SE(*b*)	t
REI Appearance/Weight Management subscale	.48**	.14	3.45	-.22	.15	-1.48
EED Weight and Shape Related Exercise subscale				2.15***	.21	10.28
R^2	.015			.135		
F for change in R^2	11.88**			105.59***		

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Regressing the EED Weight and Shape Related Exercise subscale and the REI Appearance/Weight Management subscale on the EDE-Q Restraint subscale, EDE-Q Eating Concern subscale, EDE-Q Shape Concern subscale, and EDE-Q Weight Concern subscale in subsequent hierarchical multiple regression analyses resulted in similar findings.

Table 21.

Summary of Hierarchical Regression Analysis for Variables Predicting EDE-Q global score (*N* = 771)

Variables	Model 1			Model 2		
	b	SE(*b*)	t	*b*	SE(*b*)	t
REI Fitness/Health Management subscale	1.65**	.50	3.31	2.90***	.60	4.85
EED Positive and Healthy Exercise subscale				-3.78***	1.02	-3.71
R^2	.015			.035		
F for change in R^2	10.95**			13.79***		

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 22.

Summary of Hierarchical Regression Analysis for Variables Predicting BES composite score (*N* = 771)

Variables	Model 1			Model 2		
	b	SE(*b*)	t	*b*	SE(*b*)	t
REI Fitness/Health Management subscale	-.03	.14	-.20	.49**	.16	3.05
EED Positive and Healthy Exercise subscale				-1.55***	.27	-5.70
R^2	< .001			.042		
F for change in R^2	.04			32.47***		

Note. *p < .05, **p < .01, ***p < .001.

Regressing the EED Positive and Healthy Exercise subscale and the REI Fitness/Health Management subscale on the EDE-Q Restraint subscale, EDE-Q Eating Concern subscale, EDE-Q Shape Concern subscale, and EDE-Q Weight Concern subscale in subsequent hierarchical multiple regression analyses resulted in similar findings.

Secondary research question.

Covariate analyses were examined on an exploratory basis after completion of primary research question analyses. First, significant Pearson's *r* correlations were observed between measures (see Table 23), and subsequent moderated multiple regression analyses were conducted.

Table 23.

Bivariate Correlation Matrix of Exercise Motives, Emotional Eating, Physical Activity, and Disordered Eating Measures (*N* = 482)

Variables	1	2	3	4	5	6	7	8	9	10
1. PHQ-9 composite score	–									
2. GAD-7 composite score	.74***	–								
3. EED Weight and Shape Related Exercise subscale	.24***	.17***	–							
4. EED Positive and Healthy Exercise subscale	-.16***	-.13***	.29***	–						
5. EDE-Q global score	.40***	.33***	.58***	-.04	–					
6. EDE-Q Restraint subscale	.21***	.17***	.45***	.09*	.74***	–				
7. EDE-Q Eating Concern subscale	.40***	.33***	.44***	-.06	.79***	.57***	–			
8. EDE-Q Shape Concern subscale	.44***	.37***	.56***	-.08*	.95***	.57***	.67***	–		
9. EDE-Q Weight Concern subscale	.43***	.35***	.53***	-.11**	.94***	.57***	.70***	.92***	–	
10. BES composite score	.50***	.41***	.36***	-.17***	.65***	.38***	.68***	.65***	.64***	–

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

The moderating effects of the PHQ-9 and the GAD-7 on the relationship between the EED Weight and Shape Related Exercise subscale and the EDE-Q global score and BES composite score were evaluated, based on analyses in Hypothesis Eight (see Figures 8-11). The relationship between EED Weight and Shape Related Exercise subscale and EDE-Q global score was moderated by PHQ-9 (see Figure 8), such that higher depression scores corresponded with higher weight- and shape-related exercise scores and higher total disordered eating scores.

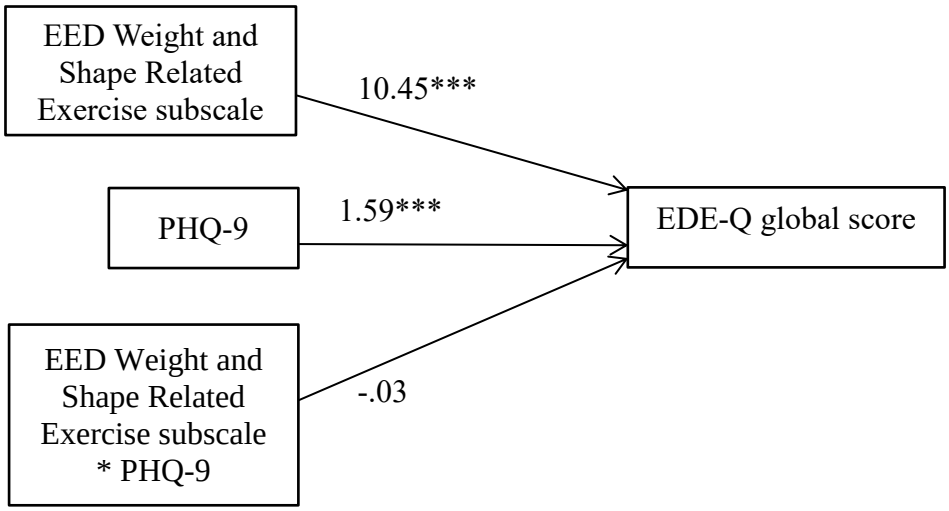

Figure 8. Moderating effects of the PHQ-9 on the relationship between the EED Weight and Shape Related Exercise subscale and the EDE-Q global score. Values presented are unstandardized coefficients. *p < .05. *p < .01 ***p < .001.

A similar relationship was found with GAD-7 as the moderator (see Figure 9), such that higher anxiety scores corresponded with higher weight and shape related exercise scores and higher total disordered eating scores.

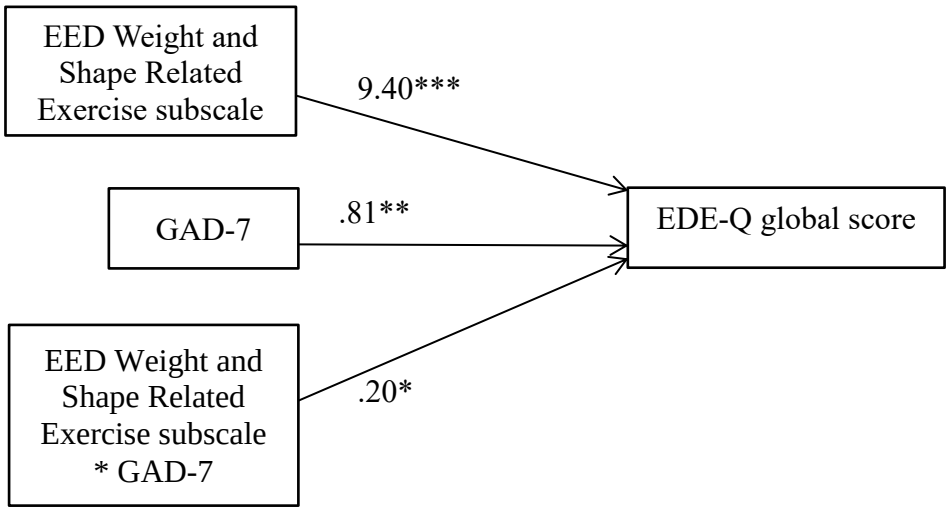

Figure 9. Moderating effects of the GAD-7 on the relationship between the EED Weight and Shape Related Exercise subscale and the EDE-Q global score. Values presented are unstandardized coefficients. *p < .05. *p < .01 ***p < .001.

Similar moderating effects of depression and anxiety on the relationship between the EED Weight and Shape Related Exercise subscale and each EDE-Q subscale were found.

The moderating effects of the PHQ-9 and the GAD-7 on the relationship between the EED Weight and Shape Related Exercise subscale and the BES composite score were also evaluated (see Figures 10–11) based on analyses in hypothesis eight. The relationship between EED Weight and Shape Related Exercise subscale and the BES composite score was moderated by PHQ-9 (see Figure 10), such that higher depression scores corresponded with higher weight- and shape-related exercise scores and higher total disordered eating scores.

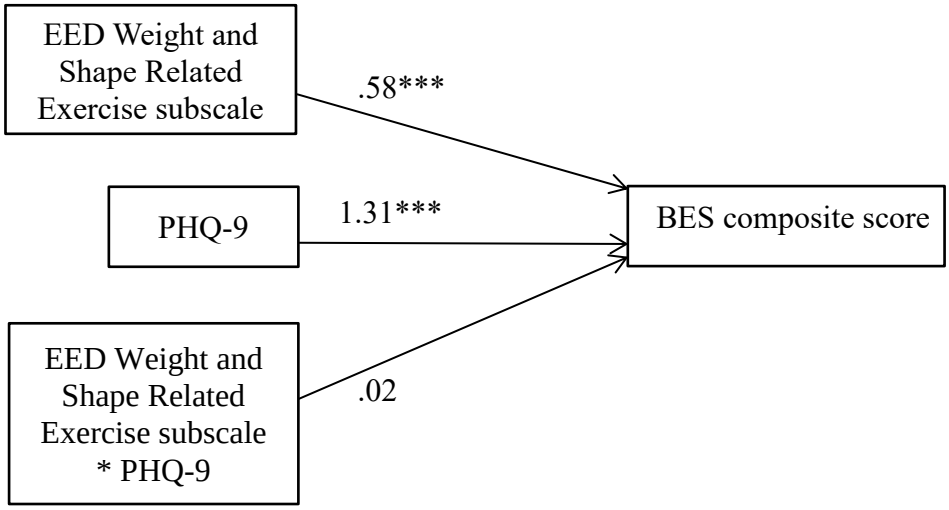

Figure 10. Moderating effects of the PHQ-9 on the relationship between the EED Weight and Shape Related Exercise subscale and the BES composite score. Values presented are unstandardized coefficients. *p < .05. *p < .01 ***p < .001.

A similar relationship was found with GAD-7 as the moderator (see Figure 11), such that higher anxiety scores corresponded with higher weight- and shape-related exercise scores and higher total disordered eating scores.

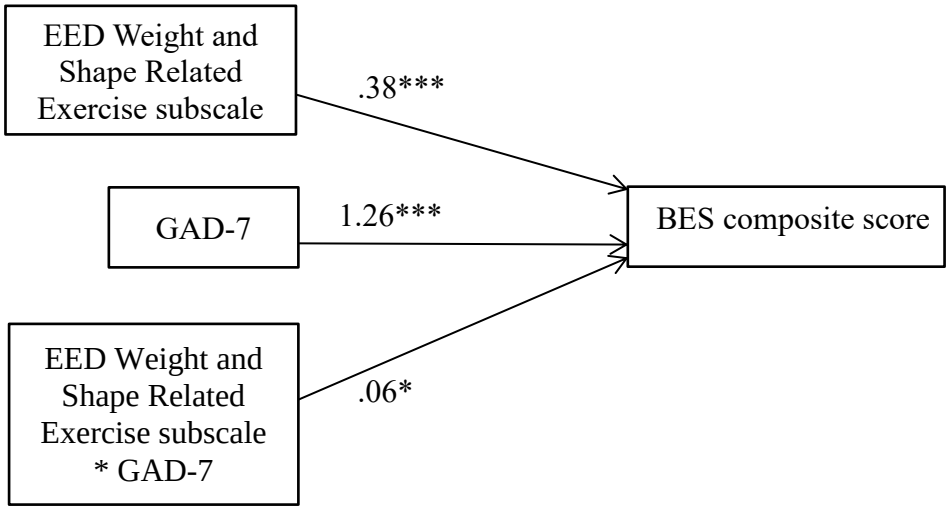

Figure 11. Moderating effects of the GAD-7 on the relationship between the EED Weight and Shape Related Exercise subscale and the BES composite score. Values presented are unstandardized coefficients. *p < .05. *p < .01 ***p < .001.

Moderated multiple regression analyses were also conducted examining depression and anxiety, independently, on the relationship between the EED Positive and Healthy Exercise subscale and disordered eating outcomes. Findings were similar as those reported above, suggesting the high rates of depression and anxiety in the sample are noteworthy in the context of measuring compulsive and unhealthy exercise and disordered eating behavior.

Discussion

Hypothesis One: REI exercise motives are associated with disordered eating outcomes.

All of the REI exercise motives, except for the Socializing subscale, accounted for a significant proportion of the variance in disordered eating outcomes. Thus, individuals who had higher fitness/health reasons for exercising endorsed more disordered eating behavior. This same relationship held for appearance/weight and stress/mood reasons for exercise.

It is noteworthy that the relationship did not hold for the socializing exercise motive because this may serve as a protective factor. While individuals who exercise for fitness/health, appearance/weight, and stress/mood reasons may be at risk for disordered eating, engaging in exercise for socializing reasons may buffer against adverse outcomes.

Hypothesis Two: Physical activity behavior is associated with disordered eating outcomes.

It was not surprising that physical activity behavior and disordered eating outcomes did not have strong associations. Without physical activity behavior acting as an intermediary between exercise motives and disordered eating, there is no obvious relationship between physical activity behavior and disordered eating outcomes. Even though excessive exercise is a compensatory behavior found in eating disorders

(American Psychiatric Association, 2013), without exercise motives to provide a qualitative definition of excessive exercise, an association between general physical activity and disordered eating outcomes did not emerge.

Hypothesis Three: Physical activity behavior moderates the relationship between REI exercise motives and disordered eating outcomes.

In contrast to earlier analyses, only physical activity behavior moderated the relationship between the REI Socializing exercise motive and disordered eating outcomes. Analyses using the other exercise motives were non-significant. Specifically, for those who engaged in a low level of physical activity, social motives conferred risk for disordered eating, whereas the reverse pattern was observed for those who were highly active, whereby higher social motives were associated with lower ED symptomatology.

While it was anticipated that knowing participants' specific exercise motives and actual physical activity behavior would provide a better understanding of what aspects of the association would be protective against disordered eating, it appears that most exercise motives alone are sufficient to predict disordered eating outcomes. However, when individuals are motivated to exercise for social reasons, it may be particularly useful to know how often they engage in physical activity.

Hypotheses Four, Five, and Six: Sport type is associated with disordered eating.

It was expected that there would be a striking difference among individuals who participated in lean versus non-lean sports because of the known associations between lean sports and disordered eating (Smolak et al., 2000). Although there were slight differences in disordered eating outcomes, individuals engaged in lean and non-lean sports were remarkably similar. Among both athlete groups, the BES did not meet the clinical cut-point for binge eating severity (Gormally et al., 1982), and all of the EDE-Q

scores were similar to the community-based normalized sample data (Fairburn & Beglin, 2008).

The data suggest two general conclusions. On one hand, it appears that engaging in sport is a protective factor against disordered eating behavior. This is generally supported by the literature (Smolak et al., 2000), although the exact relationship between sports and eating disorders remain equivocal (Chapman & Woodman, 2015; Johnson, Powers, & Dick; 1999). Thus, it is possible that the sample does not include any advanced athletes who were at a greater risk for disordered eating.

On the other hand, the analyses were likely under-powered to detect significant differences between lean and non-lean sport athletes. Out of over 1,000 participants, less than 100 participated in a lean or non-lean sport. It is possible that future research that deliberately over-samples student athletes may find a difference between lean and non-lean sports.

Hypothesis Seven: Assessing Convergent Validity of EED.

Good convergent validity was found between the EED and the EDE-Q, which replicated previous researchers' findings (Danielsen et al., 2015). Importantly, the present study contributes to the literature with novel results, suggesting good convergent validity between specific subscales on the EED and REI. Because the EED has not been previously validated against an exercise motive measure, it is important that a well-established exercise motive measure converges with it.

Hypothesis Eight: Does the EED account for additional variance when predicting disordered eating?

As expected, the EED accounted for additional variance, after controlling for the REI, when predicting disordered eating outcomes. Importantly, the REI was no longer a

significant predictor of disordered eating once the EED was entered into the model indicating that.

When comparing items on the subscales of the REI and EED, the efficacy of the EED becomes even clearer. On the REI Appearance/Weight Management subscale, one of the reasons for exercising is, “To lose weight.” In comparison, “I am physically active to become thin,” is an item on the EED Weight and Shape Exercise subscale. The items on these measures differ in their fundamental approach toward exercise. The EED addresses excessive exercise in the context of ED symptomatology by using language that includes thinness and engaging in physical activity. In contrast, the REI item measures motivation for exercise, but the immediate connection to disordered eating is not present. The REI item alone may be useful because some individuals engage in maladaptive exercise patterns for weight-related reasons (Löwe et al., 2008). However, a number of people also engage in healthy exercise to lose weight (Wing & Phelan, 2005), reducing the overall utility of the REI when attempting to predict disordered eating. This is consistent across each of the items found in the REI and EED.

The REI is likely to be missing key components related to excessive or compulsive exercise that are better captured in the EED in predicting disordered eating. Compared with only 1.5–8.1% of the variance accounted for by the REI, the EED accounted for 13.5–34% of the variance in disordered eating (after controlling for the REI). Thus, when studying a population that is particularly susceptible to excessive exercise, it may be important to utilize the EED instead of the REI in order to examine exercise motives.

Limitations

The current study had several limitations. Because approximately one-third of participants did not complete the GPAQ, a significant amount of data were missing for

that variable. Although this was comparable to missingness found in the IPAQ in a different study conducted by our lab, it is concerning that such a high proportion of participants were unable to complete the measure in the online survey format. As a result, analyses using the GPAQ were limited by a reduced sample size. For similar studies in the future, researchers should consider using the GPAQ as intended by administering it as a telephone questionnaire, or conducting an in-person administration of the measure to minimize missingness.

Another limitation of the present study was the use of BMI to discriminate between lean and non-lean athletes. It is not surprising that the athletes were considered overweight, according to BMI, because BMI is a problematic variable for most athletes. A recent study conducted by Garrido-Chamorro and colleagues (2009) on nearly 4,000 athletes indicated that BMI cannot be used a precise indicator of fat content for athletes due to the variability in fat percentage and muscle percentage across athletes with similar BMI. BMI is a crude evaluator of weight status, whereas fat percentage and muscle percentage more accurately discern the health of an athlete. Thus, the current study was limited in its ability to describe the weight status of athletes. Future research should assess body fat percentage, muscle percentage, and more when evaluating the differences between lean and non-lean athletes.

Finally, the current study sample was limited to college students. Although the EED has not been examined in a college sample, the remaining measures have been extensively utilized in college samples. Because one of the aims of the present study was to examine athletes' excessive exercise and disordered eating outcomes, assessing undergraduate students from psychology courses is a fairly restricted range. Future studies should continue examining undergraduate students from the athletic or sports medicine departments to obtain a more generalizable sample of athletes.

Strengths/Future Directions

This study is novel and contributes to the literature in several ways. To my knowledge, this study is the first that has utilized the WHO Recommendations as a cut-point to verify if a participant is an athlete, rather than simply relying on their self-identification as an athlete. Because the WHO Recommendations were utilized to distinguish between true athletes and non-athletes, the current study determined that while 80 participants indicated that they were participating in some type of sport, they did not actually engage in sufficient physical activity on a regular basis. Otherwise, a reliance on participants' self-identification as an athlete would have been concerning because a significant proportion of the athlete sample would not have been very physically active, relative to WHO standards for general health behavior. Future research should consider additional qualifiers to ensure that self-identified athletes are true athletes.

In addition to distinguishing between self-identified athletes and true athletes, future research should also critically evaluate the status of our general college student population and their level of physical activity involvement. It was striking to learn that approximately 600 college students did not participate in any type of athletic sport, including intramural club or community sport. This is concerning because college students should be engaging in some type of minimum level of physical activity because of its associated health benefits. Furthermore, the 224 participants with a physical disability or medical condition is alarming, especially considering this is a young student population. Additionally, over half of the sample endorsed at least mild depression and anxiety. Since a majority of the 224 participants endorsed a chronic physical disability, this suggests that more psychoeducation on how exercise can improve wellness and quality of life may be useful for this group. Ströhle (2009) suggests that while more research is indicating the clinical effectiveness of exercise treatments for individuals with

depression (Blumenthal et al., 1999; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005) and anxiety (Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991), few clinicians are implementing exercise as an intervention for depression or anxiety. Therefore, it is possible that providing psychoeducation to the public is insufficient. Clinicians will also need to be convinced to incorporate exercise as a regular aspect of treatment.

As an aspect of including exercise as a regular component of psychological treatment, it is important to understand the barriers that keep students from engaging in exercise. The Exercise Benefits/Barriers Scale (EBBS; Sechrist, Walker, & Pender, 1985) has been developed to understand the perceptions of individuals' benefits and barriers to engaging in exercise. Research on exercise barriers may help understand why so many college students do not participant in sports or regularly engage in physical activity.

Although the EED is a new measure that incorporates compulsive exercise not previously measured in other questionnaires, such as the REI, it is not as well-supported by theory. The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2; Markland, & Tobin, 2004) is a measure that was developed from the perspective of self-determination theory, and addresses similar exercise motives. However, there is a key distinction between the EED and BREQ-2. Individuals who complete the REI are reporting on their reasons for engaging in current practices of exercise, whereas the BREQ-2 accounts for amotivation to exercise. The BREQ-2 can better address the types of exercise motives as they relate to specific behaviors along the STD motivation continuum. This includes a complete lack of motivation to exercise. It may be important to understand why and who endorses amotivation and its relationship to disordered eating. Future research should consider validating the EED against the BREQ-2.

Conclusions

Based on the current findings, there is evidence that engaging in exercise for socializing reasons may be a protective factor against disordered eating for some people. Importantly, engaging in higher levels of physical activity related to higher socializing exercise motives is associated with lower disordered eating outcomes. Adams and colleagues (2017) conducted a recent study on psychosocial factors associated with walking to work with individuals under age 30. Similar to the present study, researchers acknowledge that many young people are working and/or taking several college courses. In an effort to capitalize on this, Adams et al. (2017) examined perceived barriers and psychosocial factors related to the likelihood of engaging in commuter walking. Interestingly, social support from colleagues was a significant barrier to commuter walking (Adams et al., 2017). This suggests that intervention efforts need to target engaging in exercise for socializing reasons and include an active peer component. Incorporating this type of physical activity program for individuals commuting to work is ideal because they can complete their WHO recommended physical activity while simultaneously getting to work and socialize with a peer.

Buckley, Westaway, and Brough (2016) analyzed a health program in which they were able to use socializing motives to engage people in natural environments. The training program exposed 3,600 participants to public hiking trails. In their study, nearly half of the sample reported participating in their program because they were enrolled with friends. Ninety-five percent of the participants indicated that the health program was a positive experience, such that it was “awesome” or “good” (Buckley et al., 2016). More intervention efforts need to target engaging in physical activity with a peer, friend, or colleague. It appears that individuals enjoy this type of physical activity, and it can be

completed on a commute to work. Importantly, exercising for socializing reasons can protect against disordered eating.

Although athletes who participate in lean sports are generally more at risk for disordered eating (Smolak et al., 2000), the current study's sample of lean sport athletes were not significantly different from the non-lean sport athletes on disordered eating outcomes, and neither group met clinically significant disordered eating outcomes. Thus, engaging in athletics may be a protective factor; the findings from the current study suggest this remains unclear.

Overall, the current study highlights the relationship between physical activity behavior, exercise motives, and disordered eating. While excessive exercise is viewed from an ED symptomology perspective, physical activity has been well-established as a health-promoting behavior. Encouraging individuals to exercise due to the socializing benefits appears to be an important way to promote healthy exercise practices. Future research should focus on interventions that add a peer or friend component to exercise programs.

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Appendices

Appendix A

Demographics Questionnaire

1. How old are you?

2. Please mark your gender.

- Male
- Female
- Transgender FTM
- Transgender MTF
- Refuse to Answer
- Other (please specify)

3. How tall are you?

Feet

Inches

4. How much do you currently weigh? (In pounds)

5. I think I am…

- Very underweight
- Slightly underweight
- Normal weight
- Slightly overweight
- Very overweight

6. Some people identify themselves as belonging to one or more racial or ethnic groups. Please check the box(es) below which correspond to group(s) you belong to:

- ☐ White or Caucasian
- ☐ Black or African-American
- ☐ Hispanic or Latino
- ☐ American Native
- ☐ Alaskan Native
- ☐ Asian
- ☐ Pacific Islander
- ☐ Middle Eastern
- ☐ Refuse to Answer
- ☐ Do you consider yourself to be of any other race or ethnic group? If so, what is it?

7. Please mark the highest level of education you have completed.

- ○ Less than High School
- ○ High School
- ○ Technical program/certificate
- ○ Associate's degree (2 years of college)
- ○ Bachelor's degree (4 years of college)
- ○ Master's degree
- ○ PhD

8. Which of the following best describes your current relationship status? Please choose one:

- ○ Single, never married
- ○ Married
- ○ Divorced
- ○ Remarried
- ○ Widowed
- ○ Separated
- ○ Living with partner (same sex)
- ○ Living with partner (opposite sex)
- ○ Refuse to Answer

9. Which of the following best describes your sexual orientation?

- ○ Heterosexual (straight)
- ○ Homosexual (gay, lesbian)
- ○ Bisexual
- ○ Prefer not to answer

- Other (please specify)

10. Which of the following categories best describes your employment status?
Please choose one:

- Full Time (>35 hrs/wk)
- Part Time (Regular hours)
- Part Time (Irregular hours)
- Working full time and going to school
- Working part time and going to school
- Full time student
- Part time student
- Unemployed
- Retired/Disability
- Military Service
- Refuse to Answer

11. What is the economic status of your current household?
Please check one:

- We have barely enough to get by
- We have enough to get by, but no more
- We are solidly middle class
- We have plenty of “extras”
- We have plenty of “luxuries”
- Don’t know/unsure/prefer not to say

12. What is your annual household income?
(Select One Answer)

- ○ >$150,000
- ○ $100,000-$149,000
- ○ $75,000-$99,000
- ○ $50,000-$74,000
- ○ $25,000-$49,000
- ○ $10,000-$24,000
- ○ <$9,000
- ○ Don't know, or prefer not to say

13. Are you currently pregnant?

- ○ Yes
- ○ No
- ○ Prefer not to answer

14. Do you have any physical disabilities and/or medical conditions that preclude or limit your involvement in physical activity?

- ○ No
- ○ Yes (please specify)

15. Do you participate in any of the following activities (select all that apply)?

- ☐ NCAA sports
- ☐ Intramural/Club sports
- ☐ Community sports
- ☐ Recreational physical activity/exercise
- ☐ None of the above *If answer YES to None of the above, skip to next questionnaire.

Via skip logic, if answer YES to any sport:

15a. What season do you play your sport (select all that apply)?

- ☐ Fall
- ☐ Winter
- ☐ Spring
- ☐ Summer

Via skip logic, if answer YES to physical activity/exercise:

15b. In what season do you typically exercise or are you physically active (select all that apply)?

- ☐ Fall
- ☐ Winter
- ☐ Spring
- ☐ Summer

16. Please select which activities you participate in (check ALL that apply).

- ☐ Baseball
- ☐ Basketball
- ☐ Bodybuilding
- ☐ Boxing/ Kickboxing
- ☐ Bowling
- ☐ Cheerleading
- ☐ Cross Country
- ☐ Dance Team/ Dance Troupe
- ☐ Disc Golf/ Ultimate Frisbee
- ☐ Dodgeball
- ☐ Equestrian/ Horseback riding
- ☐ Figure skating
- ☐ Flag Football
- ☐ Football
- ☐ Golf
- ☐ Gymnastics
- ☐ Hockey/ Ice Hockey/ Roller Hockey
- ☐ Judo/Jujitsu/Sombo
- ☐ Lacrosse
- ☐ Mixed Martial Arts
- ☐ Racquetball
- ☐ Rowing
- ☐ Sailing
- ☐ Soccer
- ☐ Softball
- ☐ Swimming & Diving
- ☐ Track & Field
- ☐ Tennis
- ☐ Volleyball
- ☐ Water Polo
- ☐ Weight Lifting

- [ ] Wrestling
- [ ] Jogging
- [ ] Running
- [ ] Salsa
- [ ] Zumba/ Pilates
- [ ] Other (please specify)

Via responses from previous question...

17. If you had to rank order the activities that you participate in, which one of them would be at the top of the list?

18. What is your current number of credit hours in school?

19. What is your current number of hours of employment per week?

Appendix B

Reasons for Exercise Inventory (REI) – Modified

To what extent is each of the following an important reason that you have for exercising?

1. To be slim.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

2. To lose weight.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

3. To maintain my current weight.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

4. To improve my muscle tone.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

5. To improve my strength.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

6. To improve my endurance, stamina.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

7. To improve my flexibility, coordination.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

8. To cope with sadness, depression.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

9. To cope with stress, anxiety.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

10. To increase my energy level.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

11. To improve my mood.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

12. To improve my cardiovascular fitness.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

13. To improve my overall health.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

14. To increase my resistance to illness and disease.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

15. To maintain my physical well-being.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

16. To improve my appearance.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

17. To be physically attractive.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

18. To be sexually desirable.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

19. To meet new people.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

20. To socialize with friends.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

21. To have fun.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

22. To redistribute my weight.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

23. To improve my overall body shape.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

24. To alter a specific area of my body.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

25. To do what is socially expected.

1	2	3	4	5	6	7
not at all important			moderately important			extremely important

Reasons for Exercise Inventory **Subscale Items** (the numbers are the item number on the measure):

Fitness/Health Management Subscale
4. To improve my muscle tone.
5. To improve my strength.
6. To improve my endurance, stamina.
7. To improve my flexibility, coordination.
12. To improve my cardiovascular fitness.
13. To improve my overall health.
14. To increase my resistance to illness and disease.
15. To maintain my physical well-being.
22. To redistribute my weight.
23. To improve my overall body shape.
24. To alter a specific area of my body.

Appearance/Weight Management Subscale
1. To be slim.
2. To lose weight.
3. To maintain my current weight.
16. To improve my appearance.
17. To be physically attractive.
18. To be sexually desirable.

Stress/Mood Management Subscale
8. To cope with sadness, depression.
9. To cope with stress, anxiety.
10. To increase my energy level.
11. To improve my mood.

Socializing Subscale
19. To meet new people.
20. To socialize with friends.
21. To have fun.
25. To do what is socially expected.

Appendix C

Global Physical Activity Questionnaire (GPAQ)

Physical Activity

Think about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person.

Think first about the time you spend doing work. Think of **work** as the things that you have to do such as paid or unpaid work, study/training, household chores. In answering the following questions *'vigorous-intensity activities'* are activities that require hard physical effort and cause large increases in breathing or heart rate, *'moderate-intensity activities'* are activities that require moderate physical effort and cause small increases in breathing or heart rate.

	Questions	Response	Code
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like *[carrying or lifting heavy loads, digging or construction work]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P 4*	P1
2	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days ⌊__⌋	P2
3	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P3 (a-b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P 7*	P4
5	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days ⌊__⌋	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P6 (a-b)
Travel to and from places			
	The next questions exclude the physical activities at work that you have already mentioned. Now, think about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship.		
7	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊__⌋	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P9 (a-b)
Recreational activities			
	The next questions exclude the work and transport activities that you have already mentioned. Now, think about sports, fitness and recreational activities (leisure).		
10	Do you do any vigorous-intensity sports, fitness or recreational (*leisure*) activities that cause large increases in breathing or heart rate like [*running or football,]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P 13*	P10
11	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊__⌋	P11
12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P12 (a-b)

Physical Activity (recreational activities) contd.			
Questions		**Response**	**Code**
13	Do you do any moderate-intensity sports, fitness or recreational (*leisure*) activities that causes a small increase in breathing or heart rate such as brisk walking *(cycling, swimming, volleyball)* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P16*	P13
14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊_⌋	P14
15	How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs mins	P15 (a-b)
Sedentary behavior			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.			
16	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes ⌊_⌋⌊_⌋ : ⌊_⌋⌊_⌋ hrs min s	P16 (a-b)

Analysis Guidelines and Calculations

Introduction

A population's physical activity (or inactivity) can be described in different ways. The two most common ways are

(1) to estimate a population's mean or median physical activity using a continuous indicator such as MET-minutes per week or time spent in physical activity, and
(2) to classify a certain percentage of a population as 'inactive' or 'insufficiently active' by setting up a cut-point for a specific amount of physical activity.

The following guidelines describe both how to derive at continuous as well as categorical indicators when analysing GPAQ data.

Continuous indicator

As described in the overview (p. 3), MET values are applied to the time variables according to the intensity (moderate or vigorous) of the activity. Applying MET values to activity levels allows us to calculate total physical activity.

For the calculation of a person's overall energy expenditure using GPAQ data, the following MET values are used:

Domain	MET value
Work	• Moderate MET value = 4.0 • Vigorous MET value = 8.0
Transport	Cycling and walking MET value = 4.0
Recreation	• Moderate MET value = 4.0 • Vigorous MET value = 8.0

WHO recommend-dations on physical activity for health

For the calculation of a categorical indicator, the total time spent in physical activity during a typical week and the intensity of the physical activity are taken into account.

Throughout a week, including activity for work, during transport and leisure time, adults should do at least

- 150 minutes of moderate-intensity physical activity OR
- 75 minutes of vigorous-intensity physical activity OR
- An equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET-minutes.

Not meeting WHO recommen-dations on physical activity for health

Description: Percentage of respondents not meeting WHO recommendations on physical activity for health (respondents doing less than 150 minutes of moderate-intensity physical activity per week, or equivalent).

Instrument questions:

- **P1-P6a&b:** activity at work
- **P7-P9a&b:** travel to and from places
- **P10-P15a&b:** recreational activities

Not meeting WHO recommendations on physical activity for health									
Age Group (years)	Men			Women			Both Sexes		
	n	% not meeting recs	95% CI	n	% not meeting recs	95% CI	n	% not meeting recs	95% CI

Questions Used	P1-P15a&b
Program	**Pnotmeetingrecs** (unweighted), **PnotmeetingrecsWT** (weighted)
Equations	Total physical activity MET-minutes/week (= the sum of the total MET minutes of activity computed for each setting) Equation: Total Physical Activity MET-minutes/week = [(P2 * P3 * 8) + (P5 * P6 * 4) + (P8 * P9 * 4) + (P11 * P12 * 8) + (P14 * P15* 4)]
Program Information	Reports percentage of respondents who do not meet WHO recommendations on physical activity for health. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).

WHO recommen-dations	Physical activity cutoff value
Not meeting recommen-dations	• IF: Total Physical Activity MET minutes per week is < 600

Created Variables	Name	Purpose	Values	Condition
	P1t3	MET value of vigorous work activity per week	P2*P3*8	P1t3CLN=1
			(.)	ELSE
	P4t6	MET value of moderate work activity per week	P5*P6*4	P4t6CLN=1
			(.)	ELSE
	P7t9	MET value of transport activity per week	P8*P9*4	P7t9CLN=1
			(.)	ELSE
	P10t12	MET value of vigorous recreational activity per week	P11*P12*8	P10t12CLN=1
			(.)	ELSE
	P13t15	MET value of moderate recreational activity per week	P14*P15*4	P13t15CLN=1
			(.)	ELSE
	Ptotal	Sum of all activity per week	p1t3+p4t6+p7t9+p10t12+p13t15	
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 **AND** P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE
	C	Output table values	"Does not meet recommendations"	Ptotal<600
			"Meets recommendations"	Ptotal≥600

Total physical activity

Description: Mean / median time of total physical activity on average per day.

Instrument questions

- **P1-P6a&b:** activity at work
- **P7-P9&b:** travel to and from places
- **P10-P15a&b:** recreational activities

Mean/Median minutes of total physical activity on average per day									
Age Group (years)	Men			Women			Both Sexes		
	n	# minutes	95% CI	n	# minutes	95% CI	n	# minutes	95% CI

Questions Used	P1-P15a&b			
Program	**Ptotal** (unweighted mean & median values), **PtotalWT** (weighted mean values), **PtotalmedianWT** (weighted median values)			
Program Information	Reports the mean or median amount of physical activity per day in minutes. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	P1t3	Vigorous work activity in minutes per week	P2*P3	P1t3CLN=1
			(.)	ELSE
	P4t6	Moderate work activity in minutes per week	P5*P6	P4t6CLN=1
			(.)	ELSE
	P7t9	Transport activity in minutes per week	P8*P9	P7t9CLN=1
			(.)	ELSE
	P10t12	Vigorous recreational activity in minutes per week	P11*P12	P10t12CLN=1
			(.)	ELSE
	P13t15	Moderate recreational activity in minutes per week	P14*P15	P13t15CLN=1
			(.)	ELSE
	Ptotalday	Sum of all activity per week divided by 7 to get avg. per day	(p1t3+p4t6+ p7t9+p10t12 +p13t15)/7	
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 **AND** P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE

Setting-specific physical activity-mean / median

Description: Mean / median number of minutes spent on average per day, in work-, transport- and recreation-related physical activity.

Instrument questions

- **P1-P6a&b:** activity at work
- **P7-P9&b:** travel to and from places
- **P10-P15a&b:** recreational activities

Mean/Median minutes of [*insert domain*]-related physical activity on average per day									
Age Group (years)	**Men**			**Women**			**Both Sexes**		
	n	# minutes	95% CI	n	# minutes	95% CI	n	# minutes	95% CI

Questions Used	P1-P15a&b			
Program	**Psetspecific** (unweighted mean & median values), **PsetspecificWT** (weighted mean values), **PsetspecificmedianWT** (weighted median values)			
Program Information	Reports the mean or median amount of physical activity in minutes. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	P1t3	Vigorous work activity in minutes per week	P2*P3	P1t3CLN=1
			(.)	ELSE
	P4t6	Moderate work activity in minutes per week	P5*P6	P4t6CLN=1
			(.)	ELSE
	P7t9	Transport activity in minutes per week	P8*P9	P7t9CLN=1
			(.)	ELSE
	P10t12	Vigorous recreational activity in minutes per week	P11*P12	P10t12CLN=1
			(.)	ELSE
	P13t15	Moderate recreational activity in minutes per week	P14*P15	P13t15CLN=1
			(.)	ELSE
	Pwork-day	Average work-related activity per day	(p1t3+p4t6)/7	
	Ptravel-day	Average transport-related activity per day	p7t9/7	
	Precday	Average recreation-related activity per day	(p10t12+p13t15) /7	
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 **AND** P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE

No physical activity by setting

Description: Percentage of respondents classified as doing no work-, transport-, or recreation-related physical activity.

Instrument questions

- **P1-P6a&b:** activity at work
- **P7-P9&b:** travel to and from places
- **P10-P15a&b:** recreational activities

No [*insert domain*]-related physical activity									
Age Group (years)	**Men**			**Women**			**Both Sexes**		
	n	%	95% CI	n	%	95% CI	n	%	95% CI

Questions Used	P1-P15a&b			
Program	**Pnoactivitybyset** (unweighted), **PnoactivitybysetWT** (weighted)			
Program Information	Reports the percentage of respondents who reported no work-, transport-, or recreation-related physical activity. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	Work	Indicates whether or not respondent did any work-related activity	"did work activity"	P1=1 OR P4=1
			"did no work activity"	ELSE
	Trans	Indicates whether or not respondent did any transport-related activity	"did transport activity"	P7=1
			"did no transport activity"	ELSE
	Rec	Indicates whether or not respondent did any recreation-related activity	"did recreation activity"	P10=1 OR P13=1
			"did no recreation activity"	ELSE
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 **AND** P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE

Composition of total physical activity

Description: Percentage of total physical activity on average per day that comes from each of the 3 types of activity: work-, transport-, or recreation-related.
Instrument questions

- **P1-P6a&b:** activity at work
- **P7-P9&b:** travel to and from places
- **P10-P15a&b:** recreational activities

Composition of total physical activity							
Age Group (years)	Gender						
	n	% Work	95% CI	% Transport	95% CI	% Recreation	95% CI

Qu. Used	P1-P15a&b			
Program	**Pcomposition** (unweighted), **PcompositionWT** (weighted)			
Program Information	Reports the percentage of activity that comes from each of the three types of activity (work, transport, or recreation). Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	P1t3	Vigorous work activity in minutes per week	P2*P3	P1t3CLN=1
			(.)	ELSE
	P4t6	Moderate work activity in minutes per week	P5*P6	P4t6CLN=1
			(.)	ELSE
	P7t9	Transport activity in minutes per week	P8*P9	P7t9CLN=1
			(.)	ELSE
	P10t12	Vigorous recreational activity in minutes per week	P11*P12	P10t12CLN=1
			(.)	ELSE
	P13t15	Moderate recreational activity in minutes per week	P14*P15	P13t15CLN=1
			(.)	ELSE
	Ptotal	Sum of all activity per week	p1t3+p4t6+p7t9+ p10t12+p13t15	
	Percent-Work	Percent of all activity from work-related activities	(p1t3+p4t6)/Ptota l*100	
	Percent-Trans	Percent of all activity from transportation-related activities	p7t9/Ptotal*100	
	Percent-Rec	Percent of all activity from recreational activities	(p10t12+p13t15)/ Ptotal*100	
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 **AND** P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE

No vigorous physical activity

Description: Percentage of respondents not engaging in vigorous physical activity.

Instrument questions

- **P1-P6a&b:** activity at work
- **P7-P9&b:** travel to and from places
- **P10-P15a&b:** recreational activities

No vigorous physical activity									
Age Group (years)	Men			Women			Both Sexes		
	n	%	95% CI	n	%	95% CI	n	%	95% CI

Qu. Used	P1-P15a&b			
Program	**Pnovigorous** (unweighted), **PnovigorousWT** (weighted values)			
Program Information	Reports percentage of respondents who did no vigorous physical activity. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1).			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	C	Output table values	"did vigorous physical activity"	P1=1 OR P10=1
			"did no vigorous physical activity"	ELSE
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P1t3CLN=1 AND P4t6CLN=1 AND P7t9CLN=1 AND P10t12CLN=1 AND P13t15CLN=1 AND P1≠(.) OR P4≠(.) OR P7≠(.) OR P10≠(.) OR P13≠(.)
			2	ELSE

Sedentary Description: Minutes spent in sedentary activities on average per day.

Instrument questions

- **P16:** sedentary behaviour

Mean/Median minutes spent in sedentary activities on average per day									
Age Group (years)	Men			Women			Both Sexes		
	n	# minutes	95% CI	n	# minutes	95% CI	n	# minutes	95% CI

Questions Used	P16a&b			
Program	**Psedentary** (unweighted mean & median values), **PsedentaryWT** (weighted mean values), **PsedentarymedianWT** (weighted median values)			
Program Information	Reports the mean or median amount of sedentary activity in minutes. Before any of the below variables are created ALL CleanRecode programs are called. To be included in the output, the respondent must have either left blank or given a valid response to each subset of the physical activity questions AND have given a valid response to at least one subset of the physical activity questions (CLN=1). Note: P16 was created in CleanRecodeP16 from P16a and P16b. It contains the total sedentary time in mins.			
Created Variables	**Name**	**Purpose**	**Values**	**Condition**
	CLN	Checks to see if all physical activity responses, as a combined set, are valid: all subsets of responses must be clean and at least one subset of responses must have a response (not missing)	1	Valid=1 AND P16CLN=1
			2	ELSE

Appendix D

Eating Disorder Examination Questionnaire (EDE-Q)

The following questions are concerned with the past four weeks (28 days) only.

Choose the appropriate number on the right.

	On how many of the past 28 days …..	**No days**	**1-5 days**	**6-12 days**	**13-15 days**	**16-22 days**	**23-27 days**	**Every day**
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
8	Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11	Have you felt fat?	0	1	2	3	4	5	6
12	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days) ……

13 Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?	……..
14 ….. On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?	……..
15 Over the past 28 days, on how many **DAYS** have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	……..
16 Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?	……..
17 Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?	……..
18 Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories?	……..

Questions 19 to 21: Please circle the appropriate number.

19 Over the past 28 days, on how many days have you eaten in secret (ie, furtively)? ….. Do not count episodes of binge eating	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
	0	1	2	3	4	5	6
20 On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? ….. Do not count episodes of binge eating	None of the times	A few of the times	Less than half	Half of the times	More than half	Most of the time	Every time
	0	1	2	3	4	5	6
21 Over the past 28 days, how concerned have you been about other people seeing you eat? ….. Do not count episodes of binge eating	Not at all		Slightly		Moderately		Markedly
	0	1	2	3	4	5	6

Questions 22 to 28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days).

	Over the past 28 days …..	Not at all		Slightly		Moderate -ly		Markedly
22	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24	How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25	How dissatisfied have you been with your weight?	0	1	2	3	4	5	6
26	How dissatisfied have you been with your shape?	0	1	2	3	4	5	6
27	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

EDE-Q **Subscale Items** (the numbers are the item number on the EDE-Q):

Restraint Subscale
1 Restraint over eating
2 Avoidance of eating
3 Food avoidance
4 Dietary Rules
5 Empty stomach

Eating Concern Subscale
7 Preoccupation with food, eating or calories
9 Fear of losing control over eating
19 Eating in secret
21 Social eating
20 Guilt about eating

Shape Concern Subscale
6 Flat stomach
8 Preoccupation with shape or weight
23 Importance of shape
10 Fear of weight gain
26 Dissatisfaction with shape
27 Discomfort seeing body
28 Avoidance of exposure
11 Feelings of fatness

Weight Concern Subscale
22 Importance of weight
24 Reaction to prescribed weighing
8 Preoccupation with shape or weight
25 Dissatisfaction with weight
12 Desire to lose weight

Appendix E

Binge Eating Scale (BES)

Below are groups of numbered statements. **Read all of the statements in each group and indicate on this page the one that best describes the way you feel about the problems you have controlling you eating behavior.**

#1

(0) 1. I don't feel self-conscious about my weight or body size when I'm with others.
(0) 2. I feel concerned about how I look to others, but it normally does not make me feel disappointed with myself.
(1) 3. I do get self-conscious about my appearance and weight which makes me feel disappointed in myself.
(3) 4. I feel very self-conscious about my weight and frequently, I feel intense shame and disgust for myself. I try to avoid social contacts because of my self-consciousness.

#2

(0) 1. I don't have any difficulty eating slowly in the proper manner.
(1) 2. Although I seem to "gobble down" foods, I don't end up feeling stuffed because of eating too much.
(2) 3. At times, I tend to eat quickly and then, I feel uncomfortably full afterwards.
(3) 4. I have the habit of bolting down my food, without really chewing it. When this happens I usually feel uncomfortably stuffed because I've eaten too much.

#3

(0) 1. I feel capable to control my eating urges when I want to.
(1) 2. I feel like I have failed to control my eating more than the average person.
(3) 3. I feel utterly helpless when it comes to feeling in control of my eating urges.
(3) 4. Because I feel so helpless about controlling my eating I have become very desperate about trying to get in control.

#4

(0) 1. I don't have the habit of eating when I'm bored.
(0) 2. I sometimes eat when I'm bored, but often I'm able to "get busy" and get my mind off food.
(0) 3. I have a regular habit of eating when I'm bored, but occasionally, I can use some other activity to get my mind off eating.
(2) 4. I have a strong habit of eating when I'm bored. Nothing seems to help me break the habit.

#5

(0) 1. I'm usually physically hungry when I eat something.
(1) 2. Occasionally, I eat something on impulse even though I really am not hungry.
(2) 3. I have the regular habit of eating foods, that I might not really enjoy, to satisfy a hungry feeling even though physically, I don't need the food.
(3) 4. Even though I'm not physically hungry, I get a hungry feeling in my mouth that only seems to be satisfied when I eat a food, like a sandwich, that fills my mouth. Sometimes, when I eat the food to satisfy my mouth hunger, I then spit the food out so I won't gain weight.

#6

(0) 1. I don't feel any guilt or self-hate after I overeat.
(1) 2. After I overeat, occasionally I feel guilt or self-hate.
(3) 3. Almost all the time I experience strong guilt or self-hate after I overeat.

#7

(0) 1. I don't lose total control of my eating when dieting even after periods when I overeat.
(2) 2. Sometimes when I eat a "forbidden food" on a diet, I feel like I "blew it" and eat even more.
(3) 3. Frequently, I have the habit of saying to myself, "I've blown it now, why not go all the way" when I overeat on a diet. When that happens I eat even more.
(3) 4. I have a regular habit of starting strict diets for myself, but I break the diets by going on an eating binge. My life seems to be either a "feast" or "famine."

#8

(0) 1. I rarely eat so much food that I feel uncomfortably stuffed afterwards.
(1) 2. Usually about once a month, I eat such a quantity of food, I end up feeling very stuffed.
(2) 3. I have regular periods during the month when I eat large amounts of food, either at mealtime or at snacks.
(3) 4. I eat so much food that I regularly feel quite uncomfortable after eating and sometimes a bit nauseous.

#9

(0) 1. My level of calorie intake does not go up very high or go down very low on a regular basis.
(1) 2. Sometimes after I overeat, I will try to reduce my caloric intake to almost nothing to compensate for the excess calories I've eaten.
(2) 3. I have a regular habit of overeating during the night. It seems that my routine is not to be hungry in the morning but overeat in the evening.
(3) 4. In my adult years, I have had week-long periods where I practically starve myself. This follows periods when I overeat. It seems I live a life of either "feast or famine."

#10

(0) 1. I usually am able to stop eating when I want to. I know when "enough is enough."
(1) 2. Every so often, I experience a compulsion to eat which I can't seem to control.
(2) 3. Frequently, I experience strong urges to eat which I seem unable to control, but at other times I can control my eating urges.
(3) 4. I feel incapable of controlling urges to eat. I have a fear of not being able to stop eating voluntarily.

#11

(0) 1. I don't have any problem stopping eating when I feel full.
(1) 2. I usually can stop eating when I feel full but occasionally overeat leaving me feeling uncomfortably stuffed.
(2) 3. I have a problem stopping eating once I start and usually I feel uncomfortably stuffed after I eat a meal.
(3) 4. Because I have a problem not being able to stop eating when I want, I sometimes have to induce vomiting to relieve my stuffed feeling.

#12

(0) 1. I seem to eat just as much when I'm with others (family, social gatherings) as when I'm by myself.
(1) 2. Sometimes, when I'm with other persons, I don't eat as much as I want to eat because I'm self-conscious about my eating.
(2) 3. Frequently, I eat only a small amount of food when others are present, because I'm very embarrassed about my eating.
(3) 4. I feel so ashamed about overeating that I pick times to overeat when I know no one will see me. I feel like a "closet eater."

#13

(0) 1. I eat three meals a day with only an occasional between meal snack.
(0) 2. I eat 3 meals a day, but I also normally snack between meals.
(2) 3. When I am snacking heavily, I get in the habit of skipping regular meals.
(3) 4. There are regular periods when I seem to be continually eating, with no planned meals.

#14

(0) 1. I don't think much about trying to control unwanted eating urges.
(1) 2. At least some of the time, I feel my thoughts are pre-occupied with trying to control my eating urges.
(2) 3. I feel that frequently I spend much time thinking about how much I ate or about trying not to eat anymore.
(3) 4. It seems to me that most of my waking hours are pre-occupied by thoughts about eating *or* not eating. I feel like I'm constantly struggling not to eat.

#15

(0) 1. I don't think about food a great deal.
(1) 2. I have strong cravings for food but they last only for brief periods of time.
(2) 3. I have days when I can't seem to think about anything else but food.
(3) 4. Most of my days seem to be pre-occupied with thoughts about food. I feel like I live to eat.

#16

(0) 1. I usually know whether or not I'm physically hungry. I take the right portion of food to satisy me.
(1) 2. Occasionally, I feel uncertain about knowing whether or not I'm physically hungry. At these times it's hard to know how much food I should take to satisfy me.
(2) 3. Even though I might know how many calories I should eat, I don't have any idea what is a "normal" amount of food for me.

Appendix F

Questionnaire on Eating and Weight Patterns-5 (QEWP-5)

8. During the past **three** months, did you ever eat, in a short period of time – for example, a 2 hour period – what most people would think was an unusually large amount of food?
YES NO *If YES, GO TO NEXT QUESTION. IF NO, SKIP QUESTIONNAIRE.

9. During the times when you ate an unusually large amount of food, did you ever feel you could not stop eating or control what or how much you were eating?
YES NO *If YES, GO TO NEXT QUESTION. IF NO, SKIP QUESTIONNAIRE.

10. During the past **three** months, how often, on average, did you have episodes like this – that is, eating large amounts of food **plus** the feeling that your eating was out of control? (There may have been some weeks when this did not happen – just average those in.)
1. Less than 1 episode per week
2. 1 episode per week
3. 2-3 episodes per week
4. 4-7 episodes per week
5. 8-13 episodes per week
6. 14 or more episodes per week

11. Did you **usually** have any of the following experiences during these episodes?
a. eating much more rapidly than normal? YES NO
b. Eating until feeling uncomfortably full? YES NO
c. Eating large amounts of food when not feeling physically hungry? YES NO
d. Eating alone because of feeling embarrassed by how much you were eating? YES NO
e. Feeling disgusted with yourself, depressed, or feeling very guilty afterward? YES NO

13. In general, during the past three months, how upset were you by these episodes (when you at a large amount of food and felt your eating was out of control)?
1. Not at all
2. Slightly
3. Moderately
4. Greatly
5. Extremely

14. During the past **three** months, did you ever make yourself vomit in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?
1. Less than 1 episode per week
2. 1 episode per week
3. 2-3 episodes per week
4. 4-7 episodes per week
5. 8-13 episodes per week
6.14 or more episodes per week

15. During the past **three** months, did you ever take more than the recommended doses of laxatives in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?

1. Less than 1 time per week
2. 1 time per week
3. 2-3 times per week
4. 4-5 times per week
5. 6-7 times per week
6. 8 or more times per week

16. During the past **three** months, did you ever take more than the recommended dose of diuretics (water pills) in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?
1. Less than 1 time per week
2. 1 time per week
3. 2-3 times per week
4. 4-5 times per week
5. 6-7 times per week
6. 8 or more times per week

17. During the past **three** months, did you ever **fast** – for example, not eat anything at all for at least 24 hours – in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?
1. Less than 1 day per week
2. 1 day per week
3. 2 days per week
4. 3 days per week
5. 4-5 days per week
6. More than 5 days per week

18. During the past **three** months, did you ever exercise excessively – for example, exercised even though it interfered with important activities or despite being injured – **specifically** in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?
1. Less than 1 time per week
2. 1 time per week
3. 2-3 times per week
4. 4-7 times per week
5. 8-13 times per week
6.14 or more times per week

19. During the past **three** months, did you ever take more than the recommended dose of a diet pill in order to avoid gaining weight after episodes of eating like you described (when you ate a large amount of food and felt your eating was out of control)?
YES NO

If YES, How often, **on average**, was that?
1. Less than 1 time per week
2. 1 time per week
3. 2-3 times per week
4. 4-5 times per week
5. 6-7 times per week
6. 8 or more times per week

20. During the past **three** months, on average, how important has your weight or shape been in how you feel about or evaluate yourself as a person – as compared to other aspects of your life, such as your performance at work or as a parent, or how you get along with other people?

1. Weight and shape were **not very important**
2. Weight and shape **played a part** in how you felt about yourself
3. Weight and shape **were among the main things** that affected how you felt about yourself
4. Weight and shape **were the most important things** that affected how you felt about yourself

QEWP-5 Scoring

Possible Diagnosis of Binge Eating Disorder (BED):
(Question 8 AND 9 = YES) + (Question 10 $\geq$ 2) + (Question 11: 3+ items indicated "YES") + (Question 13 = 4 OR 5).

Possible Diagnosis of Bulimia Nervosa (BN):
(Question 8 AND 9 = YES) + (Question 10 $\geq$ 2) + (One of the following questions: 14, 15, 16, 17, 18, OR 19 $\geq$ 2) + (Question 20 = 3 OR 4).

Appendix G

Exercise and Eating Disorders Questionnaire (EED)

Please mark the alternative for each statement that you mostly agree with.

1. I am physically active to avoid dealing with negative emotions.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

2. It feels wrong if I can't be physically active every day.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

3. If I haven't been physically active I don't eat.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

4. If I haven't been physically active, I can't relax.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

5. If I haven't been physically active, I get a bad conscience.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

6. If I haven't been physically active, my body feels big.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

7. If I haven't been physically active, my body feels disgusting.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

8. I listen to my body.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

9. I enjoy being physically active.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

10. I like to exercise with other people.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

11. I am physically active to be healthy.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

12. I notice when I get tired.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

13. I notice when I get thirsty.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

14. I notice when I get hungry.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

15. I notice when I feel fit/in shape.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

16. I am physically active to become thin.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

17. I am physically active to burn calories I have eaten.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

18. I am physically active for appearance reasons.

0	1	2	3	4	5
never	seldom	sometimes	often	usually	always

Exercise and Eating Disorders Questionnaire **Subscale Items** (the numbers are the item number on the measure):

Compulsive Exercise subscale
1. I am physically active to avoid dealing with negative emotions.
2. It feels wrong if I can't be physically active every day.
3. If I haven't been physically active I don't eat.
4. If I haven't been physically active, I can't relax.
5. If I haven't been physically active, I get a bad conscience.
6. If I haven't been physically active, my body feels big.
7. If I haven't been physically active, my body feels disgusting.
8. I listen to my body.

Positive and healthy exercise subscale
9. I enjoy being physically active.
10. I like to exercise with other people.
11. I am physically active to be healthy.

Awareness of bodily signals subscale
12. I notice when I get tired.
13. I notice when I get thirsty.
14. I notice when I get hungry.
15. I notice when I feel fit/in shape.

Weight and shape exercise subscale
16. I am physically active to become thin.
17. I am physically active to burn calories I have eaten.
18. I am physically active for appearance reasons.

Appendix H

Patient Health Questionnaire (PHQ-9)

1. Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several days	More than half the days	Nearly every day
B1. Little interest or pleasure in doing things	○	○	○	○
B2. Feeling down, depressed, or hopeless	○	○	○	○
B3. Trouble falling or staying asleep, or sleeping too much	○	○	○	○
B4. Feeling tired or having little energy	○	○	○	○
B5. Poor appetite or overeating	○	○	○	○
B6. Feeling bad about yourself - or that you are a failure or have let yourself or your family down	○	○	○	○
B7. Trouble concentrating on things, such as reading the newspaper or watching television	○	○	○	○
B8. Moving or speaking so slowly that other people could have noticed? Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual	○	○	○	○
B9. Thoughts that you would be better off dead or of hurting yourself in some way	○	○	○	○

If you checked off any problems (items B1 - B9), how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

○ Not difficult at all
○ Somewhat difficult
○ Very difficult
○ Extremely difficult

Appendix I

Generalized Anxiety Disorder (GAD-7)

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all sure	Several days	Over half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3
Add the score for each column	+	+	+	
Total Score *(add your column scores)* =				

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all _____
Somewhat difficult _____
Very difficult _____
Extremely difficult _____

Appendix J

Emotional Eating Scale (EES)

We all respond to different emotions in different ways. Some types of feelings lead people to experience an urge to eat. Please indicate the extent to which the following feelings lead to you feel an urge to eat by checking the appropriate box.

	0 (No Desire to Eat)	1 (A Small Desire to Eat)	2 (A Moderate Desire to Eat)	3 (A Strong Urge to Eat)	4 (An Overwhelming Urge to Eat)
Resentful					
Discouraged					
Shaky					
Worn Out					
Inadequate					
Excited					
Rebellious					
Blue					
Jittery					
Sad					
Uneasy					
Irritated					
Jealous					
Worried					
Frustrated					
Lonely					
Furious					
On Edge					
Confused					
Nervous					
Angry					
Guilty					
Bored					
Helpless					
Upset					

EES Scoring (a list of the emotion words for each subscale)
Each subscale is summed and averaged.

Anger/Frustration Subscale

- Resentful
- Discouraged
- Inadequate
- Rebellious
- Irritated
- Jealous
- Frustrated
- Furious
- Angry
- Guilty
- Helpless

Anxiety Subscale

- Shaky
- Excited
- Jittery
- Uneasy
- Worried
- On Edge
- Confused
- Nervous
- Upset

Depression Subscale

- Worn Out
- Blue
- Sad
- Lonely
- Bored

Appendix K

Informed Consent Form

Thank you for your interest in participating in this survey. Before you agree to continue, you need to know why we are doing this research and what we will be asking you to do. Please read the following information carefully.

What will you have to do? We are asking you to fill out a survey that will take about 45 minutes to complete. Questions on the survey will ask you about your exercise behavior and your attitudes about food.

Who are the researchers and what do they hope to find out? The study is being conducted by Megan Pejsa-Reitz and Dr. Karen Saules from the Department of Psychology at Eastern Michigan University. The researchers are trying to learn more about how food attitudes and exercise are related.

Who can take part? This survey is open to individuals who are at least 18 years old.

How will your privacy and confidentiality be respected? Your responses are confidential, and will remain so because no personally identifying information is included in the questionnaires. Results will be presented without any individually identifying information. If you provide us with your identifying information (to receive course credit), there is no way for us to link that back to the data you provide on the survey. If you request, we can tell your instructor that you participated, but no other information will be shared.

What if you decide to stop? Taking part in this study is completely voluntary and you have the right to end your participation at any time without any negative consequences or loss of benefits to which you might otherwise be entitled. We appreciate as much information as you are comfortable providing.

What are the risks of taking part in this study? Taking part in this study has no major foreseeable risks. If, however, answering this survey causes you distress for which you might like some assistance, please note that free psychological services are available to EMU students through EMU Counseling & Psychological Services (734.487.1122). You may also call one of the researchers, Dr. Saules (734.487.4987), and she will be happy to speak with you about other referral sources that might be able to assist you.

What is in it for you and others? Sharing your experiences may not benefit you directly, but it will contribute to a greater understanding of these experiences in the scientific literature, which may benefit other individuals in the future.

Will you be compensated for your participation? Compensation is not available for your participation. However, you may be eligible for extra credit, depending on the policies of your instructors.

What will be done with the results? The results will be used for a master's thesis and may be sent to scientific journals for publication and to professional conferences for presentation to the scientific community. All results will be presented in group format, without any individually identifying information, so your responses will remain completely confidential.

Whom should you contact if you would like a copy of the results? Results may not be available for a year after you complete the survey, but if you wish to learn about what we find, you may contact Megan Pejsa-Reitz at mpejsa@emich.edu.

Whom should you contact if you have questions about the study? You may contact: Megan Pejsa-Reitz (mpejsa@emich.edu), or Dr. Karen Saules (734.487.4987 or ksaules@emich.edu) of the Eastern Michigan University Department of Psychology if you have any questions or concerns.

Whom should you contact if you have questions about your rights as a research participant? This research protocol and informed consent document has been reviewed and approved as Exempt by the Eastern Michigan University Human Subjects Review Committee (UHSRC) for use from _____ through _____; approval number UHSRC: #_____. If you have questions about the approval process, please contact the UHSRC at human.subjects@emich.edu or call 734-487-0042.

What should you do if you wish to take part in this study? If you have read all of the above information and would like to take part in this study, click the "next" button below. By doing so, you are giving informed consent for us to use your responses in this study. You may wish to print this page for your records.

If you do not wish to take part in this study, just close this window.

- o NEXT. I wish to participate.

- o No, thank you. I do not wish to participate.

Appendix L

Institutional Review Board Approval Letter

RESEARCH @ EMU

UHSRC Determination: **EXEMPT**

DATE: **March 13, 2016**

TO: **Megan Pejsa-Reitz, B.S.**
Department of Psychology
Eastern Michigan University

Re: **UHSRC: #867010-1**
Category: Exempt category *2*
Approval Date: March 13, 2016

Title: **An exploration of the aspects of physical activity and exercise motives that confer risk versus protection from disordered eating outcomes**

Your research project, entitled **An exploration of the aspects of physical activity and exercise motives that confer risk versus protection from disordered eating outcomes,** has been determined **Exempt** in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

Renewals: Exempt protocols do not need to be renewed. When the project is completed, please submit the **Human Subjects Study Completion Form** (access through IRBNet on the UHSRC website).

Modifications: You may make minor changes (e.g., study staff changes, sample size changes, contact information changes, etc.) without submitting for review. However, if you plan to make changes that alter study design or any study instruments, you must submit a **Human Subjects Approval Request Form** and obtain approval prior to implementation. The form is available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events, subject complaints, or other problems that may increase the risk to human subjects **or** change the category of review must be reported to the UHSRC via an **Event Report** form, available through IRBNet on the UHSRC website

Follow-up: If your Exempt project is not completed and closed after **three years**, the UHSRC office will contact you regarding the status of the project.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

Alissa Huth-Bocks, Ph.D.
Chair
CAS Human Subjects Review Committee

Generated on IRBNet