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Exercise has typically been considered beneficial to human health because of its ability to enhance physiological and psychological well-being. Appropriate physical activity is likely to prevent numerous health problems such as heart disease, diabetes, osteoporosis, and some cancers (American College of Sports Medicine, 1995; De Coverly Vale, 1987; World Health Organization, 2002). It also tends to alleviate various psychological problems such as depression and anxiety. In addition, exercise may elevate mood states and increase self-esteem (Steinberg et al., 1998; World Health Organization, 2002). For these reasons, health care professionals have been encouraging the public to integrate exercise into their daily routine. They feel it will improve overall health, which will in turn, improve overall life satisfaction (Torre, 1995). Society's emphasis on exercise can be further recognized by the recent increase of fitness facilities being built across the United States (Davis, 1999) over the past several decades. There are now more than 15,000 health clubs and other fitness facilities in this country (Health Club, 1998). It appears that this push for exercise has led to a society that is preoccupied with health and reverence for the body. As a result, some individuals appear to engage in excessive exercise (Torre, 1995). This extreme behavior pattern may actually place individuals at risk for both physical and psychological problems rather than prevent them. Some have even proposed that individuals are becoming addicted to exercise (De Coverly Vale, 1987; Hausenblas & Downs, 2002a; Loumidis & Wells, 1998). Although it is universally agreed that physical activity is beneficial to health, there is disagreement regarding the requirements or guidelines proposed for healthy
exercise behavior. In 1978, the first attempt was made to define the amount of physical activity needed to improve fitness and human adult health. The American College of Sports Medicine (ACSM) conducted a comprehensive literature review in order to develop and publish "The Recommended Quantity and Quality of Exercise for Developing and Maintaining Fitness in Healthy Adults" (ACSM, 1978). These guidelines suggested that individuals engage in some sort of aerobic activity (swimming, cycling, skiing, jump rope, etc) at least 3-5 times a week for the duration of 15-60 minutes. The intensity of this training required individuals to work up to 60 to 90 percent of their maximum heart rate or 50 to 85 percent of their maximum oxygen uptake. This guideline was readily adopted and recommended by health care professionals around the world.

As time passed, however, individuals began to criticize and question these regulations, which soon led to the ACSM revising their initial recommendations. During the revisions, ACSM acknowledged that anaerobic activity (strength training) was just as important as aerobic activity. In addition, the ACSM and many other organizations began to recognize that various durations, frequency, and intensity of exercise can be beneficial to individual's health (ACSM, 1990). In 2000, the U.S Department of Health and Human Services (U.S. DHHS) recommended for individuals to engage in a moderate to light amount of exercise for 30 minutes a day in order to maintain good health. In addition, the U.S. DHHS recommended that individuals engage in vigorous strength training throughout the week (U.S. DHHS, 1991). These recommendations were supported by research conducted by Hansen, Stevens, and Coast (2001) who found that daily, moderate
physical activity increased energy, decreased fatigue, and decreased total negative mood states.

As seen above, there are various views about what frequency, duration, and intensity of exercise are required to achieve and maintain good health. However, it appears that the research and recommendations are biased in that they only examine the minimum amount of exercise needed to maintain good health. There has only been a limited amount of research on whether or not there should be a ceiling placed on the recommended amount of daily exercise (Sallis & Owen, 1999). Cameron & Hudons's (1986) study supports the need for a ceiling being placed on exercise. They found that both individuals diagnosed with an anxiety disorder and the control group, individuals without an anxiety disorder, experienced increasingly more anxiety when exercise was increased sequentially through five stages, from "very mild" to "very vigorous" exercise. From this study, it can be proposed that excessive exercise may have negative consequences.

*Exercise Dependency*

It has been proposed that some individuals, who engage in significantly more exercise than the previously stated recommendations, may experience problems that are reflective of dependency. Exercise is a stimulant that leads to physiological arousal and elevated mood states, leaving, perhaps, certain individuals vulnerable to exercise addiction. This can have as many implications for functioning as drug or alcohol dependency. Due to the fact that extreme exercisers experience similar clinical features as drug or alcohol addicts, it has been suggested that this condition be referred to as exercise dependency (De Coverly Veale, 1987). Exercise dependency has also been referred to in
the literature as obligatory exercise, compulsive exercise, excessive exercise, runner's addiction, and so forth. (De Coverly Veale, 1987; Keski-Rahkonen, 2001; Hausenblas & Downs, 2000c).

Presently, there is not a standard definition for exercise dependency. It has been proposed that the defining characteristics be modeled after the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) diagnostic criteria for substance abuse, which includes both a biomedical and psychological perspective (American Psychological Association, 1994; De Coverly Vale, 1987). Hausenblas and Downs (2000a) have attempted to accomplish this by defining exercise dependency as "a craving for leisure-time physical activity, resulting in uncontrollable excessive exercise behavior, that manifests in physiological (e.g. tolerance/withdraw) and/or psychological (e.g. anxiety, depression) symptoms." (p. 90) This definition has operationalized exercise dependency as a multidimensional maladaptive pattern of behavior that leads to clinically significant impairment in several areas of functioning (see Appendix A). These maladaptive patterns may include becoming preoccupied with physical activity and allowing it to take precedence over all domains of functioning. Extreme exercisers may become rigid and inflexible about their exercise routine. They are likely to feel depressed, anxious, fatigued, and/or guilty when they are not able to exercise or stick to their routine. As a result, their personal, social, and occupational life may suffer (Loumidis & Wells, 1998; McKenzie, 1999; Ogden, Veale, & Summers, 1997). Abusing exercise also appears to place physical health at risk. Excessive exercise may weaken individual's immune system making people vulnerable to disease. In addition, many of these people may exacerbate their condition by continuing to work out during illness and injury (Benyo, 1990).
Several theories have been proposed to help explain and understand exercise dependency. One explanation for exercise dependency centers on the physiological model of tolerance and withdraw associated with many addictions (Hausenblas & Downs, 2002a). It is believed that habitual exercise increases fitness levels, efficiency of energy use, and a decrease in negative mood states. As a result, exercisers must increase the frequency and duration of exercise over time to achieve a desired level of arousal and mood (Loumidis & Wells, 1998). One of the most salient characteristics of any dependency is the negative mood states that manifest in the absence of the drug, object, or activity (Russell, 1976). Withdrawal symptoms are not exclusive to substances (e.g. drugs, alcohol), as they occur in other high frequency behaviors such as gambling (Wray, Phil, & Dickerson, 1981). This theory can also be applied to exercise that occurs in high frequency. For example, addiction may occur if exercisers build a tolerance for their stimulant (exercise) forcing them to significantly increase the amount of exercise needed to achieve positive feelings. When individuals are not able to increase their level of exercise or are prevented from exercising, withdrawal symptoms occur (Hausenblas & Downs, 2002a). These symptoms include sleep disturbance, fatigue, and muscle soreness. In addition, these people may experience depression, anhedonia, and anxiety (Loumidis & Wells, 1998, Veale, 1991; Szabo, 2000; Benyo, 1990).

Another theory that attempts to explain exercise dependency centers on the activation of the endogenous opioid system. Exercise has been found to produce natural opiates (endorphins) which create similar effects to taking an opiate drug (Koob, Rassnick, Heinrichs, & Weiss, 1994). The release of natural opiates produce a number of positive effects such as creating a feeling of euphoria, often know as a “runner’s high,”
(Koob, et al., 1994) replenishing energy levels (Thoren, Floras, Hoffman, & Seals, 1990), and increasing pain tolerance (Goldfarb & Jamurtas, 1997). For these reasons exercise becomes very reinforcing. Similar to opiate drug use, however, an individual builds a tolerance to exercise and must increase the level of activity to experience the positive effects (Pierce, Eastmnan, Tripathi, Olson, & Dewey, 1993).

Another physiological explanation deals with the release of catecholamines. Catecholamines, such as adrenaline, are responsible for the physiological arousal associated with exercise. Over time, exercise results in a lower secretion level of adrenaline, which results in lower arousal and increased fatigue. This further indicates that individuals must increase their exercise level in order to reach a state of arousal (Thompson & Blaton, 1987). Catecholamines have also been found to influence attention, mood, and stress responses. Therefore, it has been proposed that individuals over engage in exercise to increase the positive mood states that are associated with exercise and the release of catecholamines (Griffiths, 1997).

Exercise dependency has also been understood by looking at psychological influences. Exercise dependent individuals seem to have similar psychological frameworks. Their level of commitment reflects obsessive personality traits. These people impose significantly high expectations on themselves and have an intense drive to reach their goals. They also have an abnormally high tolerance for physical discomfort that allows them to push their body to the limit (Davis, Brewer, & Ratusny, 1993; Gulkem, Laskis, & Kuba, 2001; Loumidis & Wells, 1998).

These theories provide an understanding for the manifestation of exercise behavior, but do not explain the maintenance of exercise behavior or dependency. As
previously stated, individuals may initially engage in physical activity because it leads to positive consequences, but it is conceivable that over time exercisers develop an unhealthy level of commitment and motivations for working out that sustain the negative behavior (Szabo, 2000). A person who has a healthy commitment level to exercise was described by Sachs (1981) as likely viewing the activity as an important but not a central component of his/her life, and probably does not suffer severe withdrawal symptoms when prevented from exercising. As a result, these individuals are able to control and regulate their exercise behaviors (Johnson, 1995). In contrast, “dependent” exercisers, with an unhealthy commitment level, tend to view exercise as a priority in their life, and experience significant withdraw when unable to exercise (Sachs, 1981). Consequently, these individuals have minimal, if any, control over their commitment to the activity (Johnson, 1995). This is significant because having minimal control over a behavior or engaging in an activity more than one intends to, is a defining characteristic of addiction (Ogden et al., 1997).

Motives behind exercise are also an important domain to understand when conceptualizing exercise dependency. People are driven to exercise for numerous reasons. For example, individuals may work out to improve their health, feel more energetic, improve their appearance, cope with stress, socialize, and/or for the satisfaction of the activity (Hausenblas & Downs, 2002a; Szabo, 2000). Some theorists make a distinction between primary exercise dependency and secondary exercise dependency. The most salient characteristic of primary exercise dependency is that exercise is the primary motivator behind the activity (DeCoverly Veale, 1987). The drive to be physically active is due to a craving for exercise that stems from physiological and
psychological symptoms (Szabo, 2000). The individual views exercise as rewarding in itself, and is not motivated by secondary gain such as weight loss. In primary exercise dependency, weight control and dieting is used to enhance performance rather than the driving force behind the activity (DeCoverly Veale, 1987). Secondary dependency, in contrast, is present when excessive exercise occurs in conjunction with an eating disorder. The main motivating force behind working out is to improve one’s body image (Szabo, 2000).

Obligatory exercise has been accepted as a defining characteristic of eating disorders such as anorexia nervosa and bulimia nervosa (APA, 1994). There have been numerous studies conducted that support the notion that excessive exercise can predict an eating disorder. For example, Thompson and Pasma (1991) found that excessive exercise positively correlates with a drive for thinness, perfectionism, and bulimia. In addition, Keski-Rahkonen (2001) conducted a review of exercise dependency literature by searching for articles in Medline. The purpose was to determine if exercise dependency could exist independent of an eating disorder. Approximately 20 articles were found and reviewed. The researcher concluded that there is minimal evidence to support exercise dependency as a distinct diagnostic category, separate from eating disorders. Thus, supporting the notion that there may be no difference between primary and secondary exercise dependency.

Researchers, however, are beginning to challenge this widely accepted idea that obligatory exercise is predictive of an eating disorder. Zmijewski and Howard (2003) examined this relationship and concluded that there is a difference between primary and secondary exercise dependency. Specifically, they found many of their subjects met the
criteria of exercise dependency in the absence of an eating disorder. Another study found that excessive runners do not share the same maladaptive thinking patterns of bulimic individuals. These runners endorsed less body image distortion and lower levels of weight preoccupation than their bulimic counterparts. As a result, the researchers concluded that excessive exercisers do not share similar body image dissatisfaction or distortions characteristic of individuals with eating disorders. Therefore, it can be proposed that eating disorders and obligatory exercise may have different underlying motivational components (Krejci et al., 1992). Furthermore, it can be proposed that exercise dependency may exist in the absence of an eating disorder. For these reasons, it is important to understand the cognitions that may be associated with exercise dependency. Exercise dependent tendencies have mainly been studied among individuals presenting with eating disorder behaviors or a tendency toward eating disorders. Thus, it has been suggested to examine exercise dependency through a conceptually different approach. Specifically, it has been proposed to study exercise dependency among the regular exercising population and by studying the motives underlying the behavior. This can be accomplished by studying the cognitions that might represent the underlying motives for exercise dependency (Rodgers et al., 2001).

**Exercise Imagery**

One relevant cognition that has been examined in relation to exercise dependency is exercise imagery (Rodgers et al., 2001, Hausenblas & Downs, 2000b). Mental imagery has been defined as "those quasi-sensory-perceptual experiences of which we are self-consciously aware and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory perceptual counterparts" (Richardson, 1969,
Essentially, this suggests that through mental imagery, individuals can see, feel, smell, hear, and/or taste without actually engaging in the activity (Hall, 2001). For example, imagery allows a swimmer to prepare for competition by imagining the feel of the water, the smell of chlorine, the sound of the start, and the sight of the competitors. These sensory experiences are committed to memory and internally recalled when needed to fulfill their purpose, such as during a work out or competition (Gould & Damaruian, 1996). Mental imagery has been associated with skill acquisition and motor control (Annette, 1995), motivational development and goal attainment (Schultheiss & Burnstein, 1999), and emotional arousal and regulation (Jones, Mace, Bray, MacRae, & Stockbridge, 2002). In some cases, it has even been found to be as effective as physical practice (Feltz & Landers, 1983). As a result, there has been a significant amount of research focusing on mental imagery in sports.

It has been suggested that imagery can have both a motivational and cognitive role in regulating behavior (Paivio, 1985). The motivational function of imagery allows an individual to vicariously live through a behavioral situation in order to attain a goal (Hall, 2001). The motivational function of imagery can occur on two levels. One level is classified as motivational specific, which involves imagining a specific goal (e.g. improving a time, winning an award). The second level is motivational general, which refers to the physiological and emotional arousal experienced during imagery (e.g. feeling psyched-up, decreased anxiety) (Cummings & Hall, 2002; Hall, Mack Pavio, & Hausenblas, 1998; Martin, Moritz, Hall, 1999). Cognitive imagery is primarily used in learning, enhancing, and maintaining performance (McLean & Richardson, 1994). Cognitive imagery also occurs on two separate levels. One level is classified as cognitive
specific imagery which refers to visualizing specific skills. For example, individuals who visualize a perfect free throw shot or tennis serve are engaging in cognitive specific imagery. The second level is cognitive general imagery, which refers to developing a strategic plan for performance. For example, an individual who imagines pacing a marathon or a skating routine is engaging in cognitive general imagery (Cummings & Hall, 2002; Hall, et al., 1998; Martin et al., 1999).

Recently, research has demonstrated that imagery is not only relevant to sports and athletes, but also has a significant role in exercise (Hausenblas, Hall, Rodgers, & Munroe, 1999, Hausenblas & Downs, 2002c; Gammage, Hall, & Rodgers, 2000). In 1995, Hall proposed that regular exercisers use imagery to achieve their desired goals. There have been several studies that have supported this hypothesis. These studies found that exercisers use three main types of imagery: energy, appearance, and technique. Energy imagery motivates exercise through the vision of becoming energized or “psyched up” for a workout. It also motivates individuals through images of alleviating daily stress via exercise. Appearance imagery motivates individuals to exercise with the vision of improved or maintained physique. Finally, individuals use technique imagery as a cognitive strategy to visualize proper skills to enhance their performance (Gammage et al., 2000; Hausenblas et al., 1999; Hausenblas & Downs, 2002c).

**Exercise Dependency and Exercise Imagery**

The research examining the relationship between exercise dependency and exercise imagery is limited and the little research that does exist is inconclusive. Recently, Rodgers et al. (2001) found that energy and technique imagery, but not appearance imagery, are associated with exercise dependency in both male and female...
marathon runners. As a result, it was concluded that appearance was not a significant motivating factor underlying exercise dependency. This finding implies that these exercisers view improved appearance as a benefit of exercise but are not primarily motivated by this reward. In contrast, Hausenblas and Downs (2002c) found in a sample consisting of both physically active undergraduate and graduate students that energy imagery predicts exercise dependency for both men and women, and that appearance imagery is a positive predictor of exercise dependency in these women. Technique imagery was not found to be predictive of exercise dependency. It is important to note that both studies found energy imagery to be a statistically significant and a meaningful predictor of exercise dependency, providing some evidence that individuals similar to the samples described above may imagine working out in order to increase their energy level or to reduce their level of daily stress (Hausenblas & Downs, 2002c; Rodgers et al., 2001). However, due to the difference in populations and measures used in these studies, more data need to be collected to further clarify these findings.

Gender and Exercise Imagery

Due to the fact that men and women may be motivated by different factors, it is important to further examine the relationship between exercise imagery and gender. It is commonly accepted that women engage in exercise as a result of society’s pressure for women to appear ultra thin (Silberstein, Streigel-Moore, Timko, & Todin, 1988). Men, on the other hand, typically engage in exercise to feed their competitive nature, competing against themselves and others (Biddle & Bailey, 1985). If these stereotypes are true, then it could be proposed that women engage in more appearance imagery than men, and that men participate in more technique imagery than women. Based on a sample that included
both college students and adults in the general population exercising at local fitness clubs and university facilities, Gammage et al. (2000) found data to support these hypotheses. Specifically, it was found that men use technique imagery more often than women. In addition, women were found to engage in more appearance imagery than men. In contrast, Hausenblas and Downs (2002c) found no sex difference for technique or appearance imagery, as physically active undergraduate and graduate men and women engaged in an equal amount of technique and appearance imagery, making it plausible that both imagery types play an important role in motivating exercise for both genders (Hausenblas & Downs, 2002b). Also of note are the discrepancies found in relation to energy imagery. Gammage et al. (2000) found no sex difference evidenced for energy imagery, while Hausenblas and Downs (2002c) found that men reported using energy imagery significantly more than women. There is a need for research to continue collecting data on gender and exercise imagery. Discrepancies in past research may be reflecting the different populations that were used in the studies.

*Gender and Exercise Dependency*

Another important area of study is how gender differences might manifest in relation to exercise dependency. There is minimal research that addresses this issue and the existing information is also inconsistent. Hausenblas and Downs (2002c) found in a combined sample of actively exercising undergraduate and graduate students, that male participants endorsed more exercise dependent symptoms compared to females as measured by the Exercise Dependence Scale (EDS). The research found that there was a significant difference among men and women on the following subscales: Lack of Control, Tolerance, Continuance, Reduction in Other Activities, Time, and Intention. The
only subscale which sex difference was not found was on the Withdraw Effects subscale. In contrast, Pierce, Rohaly, and Fritchly (1997) found that females reported significantly higher exercise dependent scores than males as measured by the Negative Addiction Scale (NAS). These inconsistencies may again be due to the fact the research included different sample populations and/or different measures. The former sample consisted of university students enrolled in sport and fitness classes and used the EDS, while the latter included only marathon runners and used the NAS (Hausenblas & Downs, 2002c; Pierce et al., 1997).

Assessment of Exercise Dependency

One prominent reason for the lack of consistency in exercise dependency research is due to the array of measures used to operationalize exercise dependency. Many of these instruments are self-report measures, which attempt to both quantify and qualify exercise behaviors, attitudes, and cognitions. The majority of early exercise dependency measures are unidimensional and operationalize exercise dependency either by exercise level, physical symptoms, or psychological symptoms, rather than assessing a variety of domains. As a result, they fail to provide a comprehensive assessment of exercise dependency (Hausenblas & Downs, 2002a; Hausenblas & Downs, 2002b). For example, the NAS was designed to measure the negative psychological components of exercise dependency and did not assess for the other domains (Hailey & Bailey, 1982; Hausenblas & Downs, 2002b). Furthermore, it focuses on the participant's degree of negative affect rather than degree of dependency. Finally, the validity and reliability of the NAS scale are unknown (Adams & Kirkby, 1982; Hausenblas & Downs, 2002a; Hausenblas & Downs, 2002c).
Due to the limitations and criticisms of unidimensional measurements, researchers have begun to develop multidimensional measures of exercise dependency. For example, the Exercise Dependence Questionnaire (EDQ) was designed to assess both the biomedical (e.g. tolerance/withdraw) and psychosocial (interpersonal/occupational functioning) aspects of dependency (Ogden et al., 1997). However, there are several problems with this scale as well. First, some items assess attitudes and social aspects of exercise rather than assessing for dependency (e.g. “I exercise to meet other people”). Second, one of the subtests consists of only two items creating inadequate internal consistency (Hausenblas & Downs, 2002a). The limitations and diversity of these measures have made it difficult for researchers to be confident in their findings and have made making comparisons across studies and time challenging.

There have been limited attempts to conceptualize and develop an organized, systematic approach to measure exercise dependency. As a result, it is highly probable that many of the developed measures and reported findings are not all truly reflective of exercise dependency. In theory, they may be addressing conceptually different issues (Hausenblas & Downs, 2002a; Sachs, 1981). For example, the Commitment to Exercise Scale (CES) is often used as a measure of excessive exercise. It has been argued, however, that commitment level and exercise dependency are two conceptually different constructs. Therefore, the CES should not be used in exercise dependency research (Sachs, 1981). Furthermore, concurrent validity between measures of “exercise dependency” have evidenced low correlations. For example, concurrent validity demonstrated low correlations between the Commitment to Running Scale and the NAS
suggesting that these instruments measure different constructs and should not be used as equal measures of the exercise dependency (Kirkby & Adams, 1996).

Finally, the majority of exercise dependency measures do not provide a criterion cut off for dependency. Furthermore, these scales do not provide information on how to interpret the scores in a meaningful manner. For example, many studies classify participants into dependency groups based on the assumption that high scores indicate dependency and low scores do not. For example, the EDQ does not specify a cut off score for identifying exercise dependency (Ogden et al., 1997) forcing researchers to pick a number they feel is appropriate for the cut-off point rather than having a standardized cut off score. As a result, the findings from studies using the EDQ have to be interpreted with significant caution.

In summary, instruments that do not provide a standardized scoring system may lead researchers to over or under predict exercise dependency. Furthermore, this approach limits the extent to which possible pathological problems can be determined. Researchers can only state which group is more or less dependent (Blaydon & Linder, 2002). There has been great need for researchers to develop a scale that can address these concerns. Hausenblas & Downs (2002b) have attempted to achieve this by developing the Exercise Dependence Scale (EDS).

**Exercise Dependence Scale**

The EDS (Hausenblas & Downs, 2002b) is a 21 item multidimensional scale that was developed with the aim of capturing the multidimensional theoretical bases of exercise dependency symptoms. This was accomplished by operationally defining exercise dependency symptoms in accordance to the DSM-IV diagnostic criteria for
substance abuse. Based on this criterion, seven subscales were identified and included to make up this scale. The subscales include: Tolerance (e.g. I continually increase my exercise intensity to achieve the desired effects/benefits), Withdrawal Effects (e.g. I exercise to avoid feeling anxious), Continuance (e.g. I exercise despite recurrent physical problems), Lack of Control (e.g. I am unable to reduce how long I exercise), Reductions in Other Activities (e.g. I think about exercise when I should be concentrating on school/work), Time (e.g. A great deal of my time is spent exercising), and Intention (e.g. I exercise longer than I plan).

An important asset of this scale is its comprehensive scoring system. The EDS total score can be used to analyze the degree of dependent symptoms, with a higher score indicating a likelihood of more exercise dependent symptoms. The total score identifies where individuals fall on the continuum from “at risk” for exercise dependency to non-dependent asymptomatic (Hausenblas & Downs, 2002b). The total score allows researchers to carry out global and practical studies with meaningful interpretation. The EDS subscale scores can be used to categorize individuals as being “at risk” for exercise dependency, non-dependent symptomatic, or non-dependent asymptomatic (Hausenblas & Downs, 2002b). These categories are very useful, as they provide cut-off scores for identifying likely exercise dependency. However, due to the fact exercise dependency is likely to effect only a small portion of the population this method often limits research because it requires an exceptionally large sample.

Another important component of this scale is its strong psychometric properties. The factorial validity, concurrent validity, internal consistency reliability, and test-retest reliability have been established (Hausenblas & Downs, 2002a, Hausenblas & Downs,
2002c). For these reasons, the EDS is considered an appropriate scale for assessing and conceptualizing exercise dependency.

Prevalence of Exercise Dependency

Determining how exercise dependency manifests in the population has been challenging for researchers. One reason is due to the fact that, prior to the EDS, there was not a well developed scale for measuring exercise dependency. In addition, many studies were exclusive in the samples they included. For example, only marathon runners or individuals who identified themselves as exercisers were allowed to participate. Furthermore, research focusing on exercise prevalence predominately looks at sedentary behavior placing health at risk and overlooks the opposite side of this paradigm: the percentage of individuals placing their health at risk by exercising to excess. Some studies have attempted to address this by examining the relationship between musculoskeletal injuries and level of physical activities. The general consensus is that injury risks increase with amount of training. For example, several studies have demonstrated that 60 to 80 percent of injuries experienced in Army basic training are related to overuse (Deuster, Jones, & Moore, 1997; Gilchrist, Jones, & Sleet, 2000; Jones, Bovees, & Harris, 1993; Jones et al., 1993). Another study found that 82.4 percent of individuals seeking care at a sports medicine clinic for hip and pelvis problems were related to overuse (Lloyd-Smith, et al., 1995). Furthermore, several studies have determined that approximately 5 to 13 percent of patients with overuse injuries experience clinically significant levels of psychological distress associated with their injury (Brewer, Linder, & Phelps, 1995; Brewer, Petitpas, Van Raalte, Sklar, & Ditmar, 1995; Brewer & Petrie, 1995; Leddy, Lambert, & Ogles, 1994). However, it is likely that
an even larger percentage of these individuals may experience psychological distress at a sub-clinical level (Heil, 1993). While these studies indicate that excessive exercise and training places individuals health at risk, they are not representative of exercise dependency. There is limited information on the prevalence of exercise dependency in the general population, much less more specific populations such as undergraduate college students.

To the author’s knowledge, there are currently no studies that evaluate how patterns of exercise dependency manifest in a general undergraduate college population. As part of the development of the EDS, Hausenblas and Downs (2002b) conducted a series of investigative studies using only physically active university students and determined that nearly 7 percent of university students were “at-risk” for exercise dependency, about 55 percent were non-dependent symptomatic, and 36 percent were non-dependent asymptomatic. Based on these findings, and the fact that a small percentage of the adult population engages in regular exercise, Hausenblas & Downs (2002b) proposed that, in a general population, the percentage of individuals found to be “at-risk” for exercise dependency would actually be much lower. However, according to Zmijewski and Howard (2003), exercise dependency may be much more prevalent in young adults than was previously thought. The present study will focus on the relationships of exercise dependency, exercise imagery, and gender in a representative undergraduate population.
Chapter II

Rationale & Hypothesis

Exercise dependency is a novel area of study. Until recently, researchers have failed to conceptualize and assess exercise dependency in a standardized manner likely leading to inconsistencies in the research findings. Hausenblas and Downs (2002a) have contributed to exercise dependency literature by providing both an operational definition of exercise dependency and developing the Exercise Dependence Scale (EDS) based upon this definition. Exercise dependency has been operationally defined as a multidimensional, maladaptive pattern of exercise, leading to clinically significant impairment in several areas of functioning (Hausenblas & Downs, 2002a). This definition and the EDS provide a way for researchers to conceptualize and measure the construct in a standardized manner, allowing for sound replication. As a result, one aim of this study is to complete a partial replication of several studies that focus on exercise dependency in order to add to the empirical data in this area. More specifically, this study aims to examine the relationship among exercise dependency, exercise imagery, and gender similarly to past literature. However, there has been no apparent attempt to assess how exercise dependency manifests in representative undergraduate samples. Thus, this study further aims to explore this relationship in a different population than previous research. Earlier research has only focused on physically active individuals, who represented combined graduate and undergraduate samples, as well as, the general exercising public (e.g. individual working out at fitness facilities).

There have been limited attempts to determine whether gender differences exist for symptoms of exercise dependency. Hausenblas and Downs (2002c) found in a
A combined sample of graduate and undergraduate students, that men reported more exercise dependency symptoms compared to women as measured by the EDS. Based on these findings, the current study proposes that there will be a significant difference in gender on exercise dependent symptoms. Specifically, it is proposed that men will score significantly higher on the following symptoms: Lack of Control, Tolerance, Continuance, Reduction in Other Activities, Time, and Intention. If consistent with past research, the only subscale which sex difference will not be evidenced is the Withdraw Effects subscale (Hausenblas & Downs, 2002c).

Due to the fact men and women are likely motivated by different factors for exercise it is also important to examine the relationship between gender and exercise imagery. Hausenblas and Downs (2002c) found no sex difference for technique or appearance imagery, but did evidence a sex difference for energy imagery in a sample of consisting of exercising undergraduate and graduate students. The men reported significantly more energy use than the women. However, research representing both the general population and college students who work out at fitness clubs and university facilities found that men use technique imagery more than women, and that women use more appearance imagery than men. There was no sex difference evidenced for energy imagery (Gammage et al., 2000). The current study hypothesizes that there will be a significant gender difference on exercise imagery. Consistent with Hausenblas and Downs, (2002c), the present study proposes that college men will engage in more energy imagery than college women.

An important component of exercise behavior is the underlying cognitions and motivations that promote the activity. Therefore, this study additionally aims to explore
the relationship between exercise dependency and exercise imagery. Research has
determined that exercises can use three types of imagery: appearance, technique, and
energy (Gammage et al., 2000; Hausenblas & Downs, 2002c; Hausenblas et al., 1999).
Hausenblas and Downs (2002c) found that energy imagery predicts exercise dependency
for both men and women undergraduate and graduate students enrolled in university sport
and fitness classes, and that appearance imagery is a positive predictor of exercise
dependency in these women. Technique imagery was not found to be predictive of
exercise dependency. In contrast, Rodgers et al. (2001) found that energy and technique
imagery, but not appearance imagery, are associated with exercise dependency in male
and female marathon runners. The present study aims to clarify the inconsistency in
research by further examining the relationship between exercise imagery and exercise
dependency in a representative undergraduate population. Due to the fact that energy
imagery is consistently found to predict exercise dependency, the current study
hypothesizes that energy imagery will be a significant predictor of exercise dependency.

Finally, this study aims to provide information on how patterns of exercise
dependency manifest in a representative undergraduate college population. There have
been no identifiable studies to establish normative data stating the percentage of
representative undergraduate students who fall into the groups: “at risk”, non-dependent
symptomatic, and non-dependent asymptomatic for exercise dependency. As part of the
scale development of the EDS, Hausenblas and Downs (2002b) determined that nearly 7
percent of physically active university students fall into a group “at risk” for exercise
dependency, about 55 percent fall into the non-dependent symptomatic group, and the
remaining 36 percent fall into the non-dependent asymptomatic group. Since, exercise
dependency may be much more prevalent in young adults than previously thought (Zmijewski & Howard, 2003), there is a need to gather more data as to how exercise dependency manifests in a general undergraduate college population. In addition, Hausenblas and Downs (2002b) studies were not randomly selected, as it appears they only included physically active individuals, thus limiting the generalizability of the findings.

Another aim of the present study is to determine if there is a statistically significant difference between the percentages of representative undergraduate students who are observed to be “at risk”, non-dependent symptomatic, or non-dependent asymptomatic for exercise dependency compared to Hausenblas and Downs’s study (2002b). In addition, the current study will provide data on the percentages of the sample falling into each category.

The following null hypotheses will be examined:

Ho1: There is no statistically significant overall gender effect for exercise dependency as measured by the EDS subscale scores.

Ho2: There is no statistically significant overall gender effect for exercise imagery as measured by the EIQ subscale scores.

Ho3: Exercise imagery as measured by the EIQ (e.g. appearance, technique, and energy) is not statistically predictive of exercise dependency as measured by the EDS total score.

Ho4: The sample distribution for exercise dependency does not differ significantly
from: 7% categorized as “at risk”, 55% categorized as non-dependent symptomatic, and 36% categorized as non-dependent asymptomatic.
Chapter III

Method

Participants

Participants for this study will be recruited from core curriculum undergraduate classes at Xavier University, a mid-western, private university. Initially, students will be recruited from general and experimental psychology courses. There are approximately 500 students enrolled in these courses for fall and spring semesters. Thus, these courses are believed to provide a solid sample size and base. If the need arises, however, participants will be recruited from other core curriculum undergraduate classes (e.g. business courses). In addition, if more subjects are still required, permission has been granted by Ashland University, a mid-western, private university, to collect additional data in a similar manner. IRB approval from each university will be received prior to recruiting subjects from the respective university (Appendix B).

To determine the number of participants needed for this study, a power analysis was based on previous exercise dependency research. Past literature has supported that 400 participants are required for a small effect to be detected (Haunsenblas and Downs, 2002b; Haunsenblas and Downs, 2002c). This study aims for a small effect size, using an alpha level of .05 and an estimated power of .80. Thus, data needs to be collected from approximately 400 individuals. In the current study, participants will represent a general undergraduate college population.

Measures

Exercise Dependence Scale (EDS)

The Exercise Dependency Scale is a multidimensional instrument used to assess exercise dependence symptoms (Haunsenblas & Downs, 2002). The EDS is comprised of
seven subscales that reflect the seven criteria for substance abuse as defined by the DSM-IV-TR (American Psychiatric Association, 1994). The subscales include: Tolerance (e.g. “I continually increase my exercise intensity to achieve the desired effects/benefits”), Withdrawal Effects (e.g. “I exercise to avoid feeling anxious”), Continuance (e.g. “I exercise despite recurrent physical problems”), Lack of Control (e.g. “I am unable to reduce how long I exercise”), Reductions in Other Activities (e.g. “I think about exercise when I should be concentrating on school/work”), Time (e.g. “A great deal of my time is spent exercising”), and Intention (e.g. “I exercise longer than I plan”). Participants are asked to endorse the level in which they engage in the item presented on a six point rating scale with 1 = never and 6 = always. The EDS total scores can be used to analyze the degree of dependent symptoms, with higher scores indicating more exercise dependent symptoms. The total score identifies where individuals fall on the continuum from “at risk” for exercise dependency to non-dependent asymptomatic. The EDS subscale scores can be used to identify a person as being “at-risk” for exercise dependency, non-dependent symptomatic, or non-dependent asymptomatic. “At-risk” individuals are those who score 15 or greater on 3 or more subscales. Non-dependent symptomatic individuals are those who score between 7 and 14 on 3 or more subscales and the “at risk” criterion is not met. Non-dependent-asymptomatic individuals are those who score 6 or less on 4 or more subscales, assuming no other criteria are met (See Appendix C).

The EDS has been found to have adequate psychometric properties for both scoring methods. Hausenblas and Downs (2002b) conducted a series of studies in order to develop the EDS. In this series, they found the internal consistency to be good to excellent ($\alpha = .80, .94, .94, .95$). This was further supported by their study (2002c) which
found the internal consistency scores for the subscales to be adequate to excellent ($\alpha$ range = .67-.93). The test-retest reliability is good, $r = .92$ (Hausenblas & Downs 2002b). The concurrent validity of the EDS was examined by comparing it to the Obligatory Exercise Questionnaire (OEQ) (Thompson & Pasma, 1991). A strong positive correlation ($r = .75, p < .05$) between the EDS and OEQ was evidenced (Hausenblas & Downs, 2002b).

**Exercise Imagery Questionnaire (EIQ)**

The Exercise Imagery Questionnaire (Hausenblas et al., 1999) will be administered to assess the type of imagery used by the participants. The EIQ consists of three subscales: Appearance, Technique, and Energy. Participants respond to each of the nine items by endorsing their level of imagery use on a nine-point rating scale anchored at the extremes with 1 = never to 9 = always. A higher score indicates greater imagery use (See Appendix D).

The EIQ has adequate psychometric properties. In previous research Cronbach’s alphas have demonstrated acceptable reliability for the EIQ subscales, with appearance ranging from .84-.87, energy ranging from .85-.90, and technique ranging from .86-.90 (Gammage et al., 2000; Hausenblas et al., 1999; Rodgers et al., 1999). Hausenblas and Downs (2002c) also determined that the internal consistency was good to excellent for the Appearance ($\alpha = .91$), Technique ($\alpha = .88$), and Energy ($\alpha = .88$) subscales. The test-retest was also adequate (Rodgers et al., appearance $r = .70$, energy $r = .74$, technique $r = .66$).

Previous research has also demonstrated that the EIQ is a valid instrument. Content validity was established with the help of three exercise professionals and three
exercise participants, who commented on wording, phrasing, and scoring of the questionnaire. Concurrent validity was established by examining the relationship between imagery use and exercise frequency (Hausenblas et al., 1999).

Procedure

This study will be conducted following all Institutional Review Board Guidelines (IRB). Participants will be recruited following the procedure outlined in the dissertation guide. The researcher will attempt to make arrangements with the professors to visit the classroom and have the students complete the study during the class period. However, if this is not successful the researcher will recruit subjects and complete the study outside of class time. All students will be provided with a written handout explaining their rights and the nature of the study (Appendix E). The handout will explain the participant’s rights to refuse or withdraw from the study at any time, confidentiality, and the benefits and potential risks of the study. In order to protect the students’ rights to confidentiality and anonymity, no identifying information will be requested, rather it will be assumed that volunteering and completing the surveys will imply consent. Some of the participants may be compensated with extra credit, subject to the professor’s discretion.

The estimated time for collecting data in each class is expected to be 10 to 15 minutes. All participants will be asked to complete the EDS and EIQ in order to gain measures of exercise dependency and imagery types. These measures will be distributed in a counterbalanced order to avoid biased responding. A supplemental questionnaire (Appendix F) will follow for the purpose of collecting sample demographics and other relevant information.
Chapter IV

Proposed Analysis

To determine if gender (IV) has a significant effect on the dependent variables, EDS and EIQ subscale scores, two one-way multivariate analysis of variance will be conducted. The Wilks’s lambda statistic will be used to see if gender accounts for a significant amount of variance in the EDS subscales and EIQ subscales. An alpha level of .05 will be used for the Wilks’s lambda statistic. If a significant difference is evidenced, follow up analysis will be performed by running univariate analysis of variance on each dependent variable using the Bonferroni method to control for Type I error. A significant difference will only be accepted at the .025 level (.05/2 = .025) (Green & Salkind, 2003).

A hierarchical multiple regression analyses will be performed to examine the relationship between exercise dependency and exercise imagery. This analysis will include one set of EIQ predictors. This set of predictors consists of measures of energy, technique, and appearance. The criterion variable will be the EDS total score. In addition, two hierarchical multiple regression analysis will be run as supplemental analysis. One will examine relationship between exercise dependency and exercise imagery for males and the other will explore this relationship for females. The criterion and predictor variables are consistent with above (Green & Salkind, 2003).

A Chi-Square goodness of fit test with unequal proportions will be performed to determine if there is a statistically significant difference between the percentages of representative undergraduate students who are observed to be “at risk” for exercise dependency, non-dependent symptomatic, and non-dependent asymptomatic compared to Hausenblas & Downs’s (2002b) study, which was based on a combined sample of
physically active undergraduate and graduate students. Hausenblas & Downs (2002b) found the sample distribution for exercise dependency to reflect the following: about 7% categorized as “at risk” for exercise dependency, 55% categorized as non-dependent symptomatic, and 36% categorized as non-dependent asymptomatic. Thus, the categories for the present statistical analysis will include 0 = non-dependent asymptomatic, 1 = non-dependent symptomatic, and 2 = “at risk.” Based off of 400 participants, the expected frequency for the 0 cell is 100, the expected frequency for the 1 cell is 260, and the expected frequency for the 2 cell is 40 (Green & Salkind, 2003). In addition, this study will report the percentage of participants who meet Hausenblas & Downs (2002b) criteria for “at risk,” non-dependent symptomatic, and non-dependent asymptomatic.
References


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http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4902a3.htm


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*Sex Roles, 19,* 219-232.


Appendix A

Proposed DSM-IV diagnostic criteria of exercise dependency

(Hausenblas & Downs, 2002a).
Appendix A

A multidimensional maladaptive pattern of exercise, leading to clinically significant impairment or distress, as manifested by three or more of the following:

1. **tolerance**: which is defined as either a need for significantly increased amounts of exercise to achieve the desired effect or diminished effect with continued use of the same amount of exercise.

2. **withdrawal**: as manifested by either withdrawal symptoms for exercise (e.g. anxiety, fatigue) or the same (or closely related) amount of exercise is taken to relieve or avoid withdrawal symptoms.

3. **intention effects**: exercise is often taken in larger amounts or over a longer period than was intended.

4. **loss of control**: there is a persistent desire or unsuccessful efforts to cut down or control exercise.

5. **time**: a great deal of time is spent in activities necessary to obtain exercise (e.g. vacations are exercise related).

6. **conflict**: important social, occupation, or recreational activities are given up or reduced because of exercise.

7. **continuance**: exercise is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by exercise (e.g. continued running despite severe shin splits).
Appendix B

Description of study submitted for IRB approval.
Appendix B

Research Dissertation Proposal Considered:

"Exempt from Review"

Student Name: Raegan Radenheimer, M.A.

Dissertation Chair: David T. Hellkamp, Ph.D.

Traditionally, exercise has been studied for its psychological and physiological benefits. Appropriate exercise has been found to prevent health problems (e.g. heart disease, diabetes) and alleviate various psychological problems (e.g. depression, anxiety) (American College of Sports Medicine, 1995; De Coverly Vale, 1987; World Health Organization, 2002, Steigernberg et al., 1998). However, exercise performed to excess may actually cause physiological and psychological problems rather than prevent them (Loumidis & Wells, 1998). Research is beginning to support the notion that certain individuals are becoming addicted to exercise (De Coverly Vale, 1987; Hausenblas & Downs, 2002a; Loumidis & Wells, 1998). Hausenblas and Downs (2002a) operationally defined exercise dependence as a multidimensional, maladaptive pattern of exercise, leading to clinically significant impairment in several areas of functioning.

There have been no apparent attempts to either replicate exercise dependency studies or assess how exercise dependency manifests in representative undergraduate samples. As a result, the aim of this study is to complete a partial replication of several studies that focus on exercise dependency in order to add to the empirical data in this area. More specifically, this study aims to complete a partial replication of several studies that examine the relationship among exercise dependency, exercise imagery, and gender. The current study is considered a partial replication because it will further examine the relationship among these variables in a different population from previous research. This study will include a sample that is representative of a general undergraduate population.

Previous research has only focused on physically active individuals, who represent combined graduate and undergraduate samples, as well as, the general exercising public (e.g. individual working out at fitness facilities). This study aims to explore the following areas: a) whether gender differences exist for symptoms of exercise dependency b) whether gender differences exist for exercise imagery c) explore the relationship between exercise dependency and exercise imagery d) provide information on how patterns of exercise dependency manifest in a representative undergraduate college sample.

Method

In order to carry out this study, participants will be recruited from core curriculum undergraduate classes at Xavier University. If the need arises, permission has been granted by Ashland University, a mid-western, private university, to collect additional data in a similar manner. IRB approval from each university will be granted prior to recruiting subjects from the respective university. The aim is to include a large number of male and female participants and to collect data that presumably includes a range of exercise behavior from sedentary to vigorous activity. These participants will be recruited...
following the procedure outlined in the dissertation guide. Initially, students from general experimental and general psychology courses will be asked to volunteer. Students from other undergraduate core curriculum courses will be recruited, if needed for obtaining the minimum number of participants (400). The researcher will make arrangements with the professors to visit the classroom and have the students complete the study during the class period. If this is unsuccessful the researcher will make arrangements to recruit subjects and complete the study outside of class time. The nature and procedures involved in the current study will be explained to all potential participants (Appendix A). The willing participants will be informed about their right to refuse or withdraw from the study at any time. In order to protect the students' rights to confidentiality and anonymity, no identifying information will be requested on the forms, rather it will be assumed that volunteering and completing the surveys will imply consent. All participants, however, will be assigned a number from 001 to 400 in order to track the material and aid with data entry. In addition, the participants will be informed of any possible benefits of participating. Some of the participants may be compensated with extra credit, subject to the professor's discretion. There are no identifiable risks for participating.

The estimated time of involvement is expected to be 10 to 15 minutes. The participants will be asked to complete a demographic questionnaire (Appendix B) for the purpose of collecting sample demographics. This is believed to contribute to the research as there appears to be no sample demographics for exercise dependency. All participants will be asked to complete the Exercise Dependency Scale (Appendix C) and Exercise Imagery Questionnaire (Appendix D) in order to gain measures of exercise dependency and imagery types. Once these measures are completed they will be placed in a folder and stored in a locked file cabinet.
Appendix C

The Exercise Dependency Scale, including instructions, questions, and subscales.
Appendix B

**Instructions:** Using the scale provided below, please complete the following questions as honestly as possible. The questions refer to current exercise beliefs and behaviors that have occurred in the **past 3 months**. Please circle the number on the scale provided from one (never) to six (always). If you do not consider yourself an exerciser, please circle number 1 for all items. Do not leave any questions blank.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Never</strong></td>
<td><strong>Always</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. I exercise to avoid feeling irritable.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I exercise despite recurring physical problems.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. I continually increase my exercise intensity to achieve the desired effects/benefits.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I am unable to reduce how long I exercise.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I would rather exercise than spend time with family/friends.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I spend a lot of time exercising.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I exercise longer than I intend.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I exercise to avoid feeling anxious.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I exercise when injured.</td>
<td>1 2 3 4 5 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please proceed to the next page
<table>
<thead>
<tr>
<th></th>
<th>(1) Never</th>
<th>(6) Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>I continually increase my exercise frequency to achieve desired effects/benefits.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>I am unable to reduce how often I exercise.</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>I think about exercise when I should be concentrating on school/work.</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>I spend most of my free time exercising.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>I exercise to avoid feeling tense.</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>I exercise despite persistent physical problems.</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>I continually increase my exercise duration to achieve the desired effects/benefits.</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>I am unable to reduce how intense I exercise.</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>I choose to exercise so that I can get out of spending time with family/friends.</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>A great deal of my time is spent exercising.</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>I exercise longer than I plan.</td>
<td></td>
</tr>
</tbody>
</table>
Subscale Breakdown:

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdrawal Effects</td>
<td>1,8,15</td>
</tr>
<tr>
<td>Continuance</td>
<td>2,9,16</td>
</tr>
<tr>
<td>Tolerance</td>
<td>3,10,17</td>
</tr>
<tr>
<td>Lack of Control</td>
<td>4,11,18</td>
</tr>
<tr>
<td>Reduction in Other Activities</td>
<td>5,12,19</td>
</tr>
<tr>
<td>Time</td>
<td>6,13,20</td>
</tr>
<tr>
<td>Intention Effects</td>
<td>7,14,21</td>
</tr>
</tbody>
</table>
Appendix D

The Exercise Imagery Questionnaire, including a description of exercise imagery,
instructions, questionnaires, and subscales.
Appendix C

Description:
Imagery involves mentally seeing yourself exercising. The image in your mind should
approximate the actual physical activity as closely as possible. Imagery may include sensations
like hearing the aerobic music and feeling yourself move through the exercises. Imagery can also
be associated with emotions (e.g. getting psyched up or energized), techniques/strategies (e.g.
form or pacing) and/or setting goals (e.g. losing weight).

Instructions: Using the scale provided below, please complete the following questions as
honestly as possible. The questions refer to the use of exercise imagery that have occurred in the
past 3 months. Please circle the number on the scale provided below, one (never) to nine
(always), to indicate the amount you engage in the listed behavior. If you do not consider yourself
an exerciser, please circle number 1 for all items. Do not leave any questions blank.

<table>
<thead>
<tr>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7 8 9</td>
<td></td>
</tr>
</tbody>
</table>

1. To keep me going during the day I imagine exercising.

1 2 3 4 5 6 7 8 9

2. I imagine a “fitter-me” from exercising.

1 2 3 4 5 6 7 8 9

3. To take my mind off my work, I imagine exercising.

1 2 3 4 5 6 7 8 9

4. When I think about exercising, I imagine perfecting my technique.

1 2 3 4 5 6 7 8 9

5. When I think about exercising, I imagine my form and body position.

1 2 3 4 5 6 7 8 9

6. To get me energized, I imagine exercising.

1 2 3 4 5 6 7 8 9

7. I imagine a “leaner-me” from exercising.

1 2 3 4 5 6 7 8 9

Please proceed to the next page

(1) (9)
8. I imagine a “firmer-me” from exercising.

   Never Always

   1 2 3 4 5 6 7 8 9

9. When I think about exercising, I imagine doing the required movements.

   1 2 3 4 5 6 7 8 9

Subscale Breakdown:

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance Imagery</td>
<td>2,7,8</td>
</tr>
<tr>
<td>Energy Imagery</td>
<td>1,3,6</td>
</tr>
<tr>
<td>Technique Imagery</td>
<td>4,5,9</td>
</tr>
</tbody>
</table>
Appendix E

Instructions to potential participants and the consent to participate form.
Appendix E

Instructions to Potential Participants

This packet contains a number of questions related to exercise behaviors and underlying motivations for physical activity. These questions can be answered by ANYONE. You do NOT need to engage in regular exercise to participate in this study. The form entitled “Consent to Participate” further explains this study. Please look over it before deciding whether or not you would like to participate.

After you read over the consent form, and if you decide to continue, please complete all materials as openly and honestly as possible. Do not leave any questions blank. When you are finished keep the “Consent to Participate” form and return all of the materials to the researcher. If you decided not to participate, simply return your packet to the researcher.

Thank you.
Consent to Participate

I agree to take part in this study conducted by Raegan Radenheimer, M.A. at Xavier University. This study examines the relationship between exercise behaviors and exercise imagery among undergraduate college students. The time commitment for the study ranges from 10 to 15 minutes.

You have been asked to participate because you are currently enrolled in Xavier University’s core curriculum undergraduate courses and you are at least 18 years of age. This study is open to all individuals, ranging from individuals who do not exercise at all to those who exercise on a regular basis.

I understand that my participation will involve completing three separate surveys and that in doing so my consent is implied. I have been instructed not to place my name or any other identifying information on the surveys. I know my name and responses to this study are completely confidential. Reports of the results will be reported in group formats. No individual names or scores will be identified.

I understand there is no direct benefit for me participating in this study. I will not receive any financial compensation, though some students may receive extra credit, per the professor’s discretion. However, by participating, I am providing information to further research in the realm of exercise behavior. There are no foreseeable risks associated with completing these surveys. While it is not possible to identify all potential risks in an experimental procedure, reasonable safeguards have been taken to minimize both the known and potential unknown risks.

I understand that participation in this study is completely voluntary and I may choose to cease participation at any time without penalty. Refusal to take part in this study will have NO effect on any future services I may be entitled to from the University.

If you have any questions about this project, Raegan Radenheimer, can be reached at 859-992-5018. Her research is supervised by David Hellkamp, Ph.D., who can be reached at 513-745-1044.

Thank you for your time and cooperation. Please keep this Consent to Participate form for possible future reference.
Appendix F

Supplemental Questionnaire
Appendix F

1. **Age:** ______

2. **Gender:** (please circle):
   - Male
   - Female

3. **Ethnicity** (please circle):
   - Caucasian
   - African American
   - Asian
   - Hispanic
   - Native American
   - Other: ____________

4. **Education** (please circle):
   What is your current level of education at Xavier University (please circle):
   - Freshman
   - Sophomore
   - Junior
   - Senior

5. **Activity type** (please circle all that apply):
   In a typical week, I usually participate in the following activities:
   - NCAA Sports
   - Intramural/Recreational Sports (e.g. softball, pick up games)
   - College Sport Clubs (e.g. rugby)
   - Aerobic/Dance Class
   - **Strength Training**
   - "Standard" Exercise (visiting the gym or fitness center, walking, running, biking, golf, yard work)
   - Other ____________

6. Approximately how many **hours** in a **typical week** do you exercise?  
   __________

7. **Imagery:** Have you ever been taught or instructed how to use imagery as an aid in your exercise? (Please circle):
   - Yes
   - No
Chapter V: Dissertation

Abstract

The current study was designed to examine the relationship among exercise dependency, exercise imagery, and gender. Based on 426 participants, the results indicated that male and female college students differ on exercise dependent symptoms, as measured by the Exercise Dependency Scale (EDS). Females scored significantly higher on the Withdraw Effects subscale, while males scored significantly higher on the Time subscale. Another important finding is that all three types of exercise imagery (i.e. appearance, technique, and energy) were found to be predictive of exercise dependency. In addition, it was found that there is no overall gender effect on type of exercise imagery used, as measured by the Exercise Imagery Questionnaire (ANOVA p ≤ .025). Furthermore, this study examined the amount (hours/week) and types of exercise (i.e. NCAA, Strength, Aerobic) reported in an undergraduate college population. Also, the present study determined the percentage of undergraduates that reported being trained in exercise imagery. Finally, based on the EDS, the present study concluded that approximately 4% of college students fall into the category “at-risk” for exercise dependency, 59% were found to be non-dependent symptomatic, and 37% were non-dependent asymptomatic. The implications of these results were also discussed.
Exercise has typically been considered beneficial to human health because of its ability to enhance physiological and psychological well-being. Appropriate physical activity is likely to help prevent numerous health problems (i.e. heart disease, diabetes) (American College of Sports Medicine, 1995; De Coverly Vale, 1987; World Health Organization, 2002) and help alleviate various psychological problems (i.e. depression, anxiety). For these reasons, health care professionals have encouraged the public to integrate exercise into their daily routine. It appears, however, that this push for exercise may have led to a society that is preoccupied with health and reverence for the body. As a result, some individuals seem to engage in excessive exercise (Torre, 1995). This extreme behavior pattern may be associated with risk for both physical and psychological problems rather than help prevent them. Some have even proposed that individuals are becoming addicted to exercise (De Coverly Vale, 1987; Hausenblas & Downs, 2002a; Loumidis & Wells, 1998).

Exercise Dependency

It has been proposed that some individuals, who engage in significantly more exercise than recommended, may experience problems that are reflective of dependency (De Coverly Veale, 1987). Exercise is a stimulant that leads to physiological arousal and elevated mood states, leaving, perhaps, certain individuals vulnerable to exercise addiction (De Coverly Veale, 1987). Presently, there is not a standard definition for exercise dependency. It has been proposed that the defining characteristics be modeled after the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) diagnostic
criteria for substance abuse, which includes both a biomedical and psychological perspective (American Psychological Association, 1994; De Coverly Vale, 1987).

Hausenblas and Downs (2000a) have attempted to establish such a definition by defining exercise dependency as “a craving for leisure-time physical activity, resulting in uncontrollable excessive exercise behavior, that manifests in physiological (e.g. tolerance/withdraw) and/or psychological (e.g. anxiety, depression) symptoms.” (p. 90) This definition has operationalized exercise dependency as a multidimensional maladaptive pattern of behavior that leads to clinically significant impairment in several areas of functioning (see Appendix A). These maladaptive patterns may include becoming preoccupied with physical activity and allowing it to take precedence over all domains of functioning. Extreme exercisers may become rigid and inflexible about their exercise routine. They are likely to feel depressed, anxious, fatigued, and/or guilty when they are not able to exercise or stick to their routine. As a result, their personal, social, and occupational life may suffer (Loumidis & Wells, 1998; McKenzie, 1999; Ogden, Veale, & Summers, 1997).

**Exercise Imagery**

People are driven to exercise for numerous reasons. For example, individuals may work out to improve their health or appearance, feel more energetic, cope with stress, socialize, and/or for enjoyment (Hausenblas & Downs, 2002a; Szabo, 2000). Due to the fact these motives usually have a cognitive component; it has been suggested to study the cognitions that might be related to exercise dependency (Hausenblas & Downs, 2000b; Paivio, 1985; Rodgers, Hall, Blanchard, & Munroe, 2001).
One relevant cognition that has been examined in relation to exercise dependency is exercise imagery (Hausenblas & Downs, 2000b; Rodgers et al., 2001). Mental imagery has been defined as "those quasi-sensory-perceptual experiences of which we are self-consciously aware and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory perceptual counterparts" (Richardson, 1969, pp 2-3). Essentially, this suggests that through mental imagery, individuals can see, feel, smell, hear, and/or taste without actually engaging in the activity (Hall, 2001). Mental imagery has been associated with skill acquisition and motor control (Annette, 1995), motivational development and goal attainment (Schultheiss & Burnstein, 1999), and emotional arousal and regulation (Jones, Mace, Bray, MacRae, & Stockbridge, 2002).

Recently, research has demonstrated that imagery is not only relevant to sports and athletes, but also has a significant role in exercise (Hausenblas, Hall, Rodgers, & Munroe, 1999, Hausenblas & Downs, 2002c; Gammage, Hall, & Rodgers, 2000). In 1995, Hall proposed that regular exercisers use imagery to achieve their desired goals. There have been several studies that have supported this hypothesis (Gammage et al., 2000; Hausenblas et al., 1999; Hausenblas & Downs, 2002c). These studies found that exercisers use three main types of imagery: energy, appearance, and technique. Energy imagery motivates exercise through the vision of becoming energized or "psyched up" for a workout and through images of alleviating daily stress via exercise. Appearance imagery motivates individuals to exercise with the vision of improved or maintained physique. Finally, individuals use technique imagery as a cognitive strategy to visualize proper skills to enhance their performance (Gammage et al., 2000; Hausenblas et al., 1999; Hausenblas & Downs, 2002c).
Exercise Dependency and Exercise Imagery

The research examining the relationship between exercise dependency and exercise imagery is limited and the little research that does exist is inconclusive. Recently, Rodgers et al. (2001) found that energy and technique imagery, but not appearance imagery, are associated with exercise dependency in both male and female marathon runners. As a result, it was concluded that appearance was not a significant motivating factor underlying exercise dependency. This finding implies that these exercisers view improved appearance as a benefit of exercise but are not primarily motivated by this reward. In contrast, Hausenblas and Downs (2002c) found in a sample consisting of both physically active undergraduate and graduate students that energy imagery predicts exercise dependency for both men and women, and that appearance imagery is a positive predictor of exercise dependency in these women. Technique imagery was not found to be predictive of exercise dependency for either sex. It is important to note that both studies found energy imagery to be a statistically significant and a meaningful predictor of exercise dependency, providing some evidence that individuals similar to the samples described above may imagine working out in order to increase their energy level or to reduce their level of daily stress (Hausenblas & Downs, 2002c; Rodgers et al., 2001). However, due to the difference in populations and measures used in these studies, more data need to be collected to further clarify these findings.

Gender and Exercise Imagery

Due to the fact that men and women may be motivated by different factors, it is important to further examine the relationship between exercise imagery and gender. It is commonly accepted that women engage in exercise as a result of society’s pressure for
women to appear ultra thin (Silberstein, Streigel-Moore, Timko, & Todin, 1988). Men, on the other hand, typically engage in exercise to feed their competitive nature, competing against themselves and others (Biddle & Bailey, 1985). If these stereotypes are true, then it could be proposed that women engage in more appearance imagery than men, and that men participate in more technique imagery than women. Based on a sample that included both college students and adults in the general population exercising at local fitness clubs and university facilities, Gammage et al. (2000) found data to support these hypotheses. Specifically, it was found that men use technique imagery more often than women. In addition, women were found to engage in more appearance imagery than men. In contrast, Hausenblas and Downs (2002c) found no sex difference for technique or appearance imagery, as physically active undergraduate and graduate men and women engaged in an equal amount of technique and appearance imagery, making it plausible that both imagery types play an important role in motivating exercise for both genders (Hausenblas & Downs, 2002b). Also of note are the discrepancies found in relation to energy imagery. Gammage et al. (2000) found no sex difference evidenced for energy imagery, while Hausenblas and Downs (2002c) found that men reported using energy imagery significantly more than women. There is a need for research to continue collecting data on gender and exercise imagery. Discrepancies in past research may be reflecting the different populations that were used in the studies.

Gender and Exercise Dependency

Another important area of study is how gender differences might manifest in relation to exercise dependency. There is minimal research that addresses this issue and the existing information is also inconsistent. Hausenblas and Downs (2002c) found in a
combined sample of actively exercising undergraduate and graduate students, that male participants endorsed more exercise dependent symptoms compared to females as measured by the Exercise Dependence Scale (EDS). The research found that there was a significant difference among men and women on the following subscales: Lack of Control, Tolerance, Continuance, Reduction in Other Activities, Time, and Intention. The only subscale which sex difference was not found was on the Withdraw Effects subscale. In contrast, Pierce, Rohaly, and Fritchly (1997) found that females reported significantly higher exercise dependent scores than males as measured by the Negative Addiction Scale (NAS). These inconsistencies may again be due to the fact the research included different sample populations and/or different measures. The former sample consisted of university students enrolled in sport and fitness classes and used the EDS, while the latter included only marathon runners and used the NAS (Hausenblas & Downs, 2002c; Pierce et al., 1997).

Prevalence of Exercise Dependency

Determining how exercise dependency manifests in the population has been challenging for researchers. One reason is due to the fact previous research has been exclusive in the samples studied. For example, only marathon runners or individuals who identified themselves as exercisers were selected. Secondly, prior to the EDS, there was not a well developed scale for measuring exercise dependency. As a result, there is limited information on the prevalence of exercise dependency in the general population, much less more specific populations such as undergraduate college students.

To the author's knowledge, there are currently are very few studies that evaluated how patterns of exercise dependency manifested in a general undergraduate college
population. As part of the development of the EDS, Hausenblas and Downs (2002b) conducted a series of investigative studies using only physically active university students and determined that nearly 7 percent of university students were “at-risk” for exercise dependency, about 55 percent were non-dependent symptomatic, and 36 percent were non-dependent asymptomatic. Based on these findings, and the fact that a small percentage of the adult population engages in regular exercise, Hausenblas & Downs (2002b) proposed that, in a general population, the percentage of individuals found to “at-risk” for exercise dependency would actually be much lower.

In contrast, Zmijewski and Howard (2003) attempted to examine the prevalence of exercise-dependence symptoms among a radon sample of 237 college undergraduates utilizing the Exercise Dependency Questionnaire (EDQ). However, the researchers were only able to make statements such as “symptoms of exercise dependence were common” (Zmijewski and Howard, 2003, p.194). Due to the fact the EDQ does not provide a standard, systematic scoring system, Zmijewski and Howard (2003) were not able to provide percentages of how exercise dependency may manifest in an undergraduate population. They did conclude, however, that “exercise dependency may be much more prevalent than previously thought, especially in young adult populations” (Zmijewski and Howard, 2003, p. 194). In summary, it is unknown how pattern of exercise dependency may manifest in a representative undergraduate population. This area has been limited by the fact that only physically active samples were studied with the measures (i.e. EDQ, EDS). Therefore, the present study will address these apparent inconsistencies in research by determining the percentage of undergraduate college students who fall into the
categories: "at-risk," non-dependent symptomatic, and non-dependent asymptomatic as measured by the EDS.

In addition, this study will examine the relationships of exercise dependency, exercise imagery, and gender in a representative undergraduate population. This study will examine the following null hypotheses:

Ho1: There is no statistically significant overall gender effect for exercise dependency as measured by the EDS subscale scores.

Ho2: There is no statistically significant overall gender effect for exercise imagery as measured by the EIQ subscale scores.

Ho3: Exercise imagery as measured by the EIQ (e.g. appearance, technique, and energy) is not statistically predictive of exercise dependency as measured by the EDS total score.

Ho4: The sample distribution for exercise dependency does not differ significantly from: 7% categorized as “at risk”, 55% categorized as non-dependent symptomatic, and 36% categorized as non-dependent asymptomatic.

Method

Participants

To determine the number of participants needed for this study, a power analysis was based on previous exercise dependency research. Past literature supported that 400 participants are required for a small effect to be detected (Hausenblas and Downs, 2002b; Haunsenblas and Downs, 2002c). In the present study, 428 participants (196 males, 229 females) were recruited from core curriculum undergraduate classes at Xavier University, a mid-western, private university. Specifically, students were recruited from general
psychology and general experimental psychology courses, and one section of a marriage
and family course. The mean age of individuals participating in this study was 19 years
(M=19.89, SD = 2.36). The sample was also fairly diverse in that all education levels,
freshman through senior, were represented and a number of different ethnicities were
included. In addition, the sample represented various types of exercise activities as well
as an estimate of hours exercising per week. The sample also represented individuals who
reported having received instruction on how to use exercise imagery as well as
individuals who have reported no previous imagery training. These data are summarized
in Table 1. Three individuals were excluded from the analysis of the first three
hypotheses and one individual was excluded for the final hypothesis due to a lack of
sufficient data provided on their surveys (i.e. demographics, EDS).

Measures

*Exercise Dependence Scale (EDS)* The Exercise Dependency Scale is a
multidimensional instrument used to assess exercise dependence symptoms (Hausenblas
& Downs, 2002b) (See Appendix A). The EDS is comprised of seven subscales that
reflect the seven criteria for substance abuse as defined by the DSM-IV-TR (American
Psychiatric Association, 1994). The subscales include: Tolerance (e.g. “I continually
increase my exercise intensity to achieve the desired effects/benefits”), Withdrawal
Effects (e.g. “I exercise to avoid feeling anxious”), Continuance (e.g. “I exercise despite
recurrent physical problems”), Lack of Control (e.g. “I am unable to reduce how long I
exercise”), Reductions in Other Activities (e.g. “I think about exercise when I should be
concentrating on school/work”), Time (e.g. “A great deal of my time is spent
exercising”), and Intention (e.g. “I exercise longer than I plan”). Participants are asked to
endorse the level in which they engage in the item presented on a six point rating scale with 1 = never and 6 = always. The EDS can be scored in two different ways. First, the EDS total scores can be used to analyze the degree of dependent symptoms, with higher scores indicating more exercise dependent symptoms. The total score identifies where individuals fall on the continuum from “at risk” for exercise dependency to non-dependent asymptomatic. However, no cut off scores are used when utilizing this method of scoring. Second, the EDS subscale scores can be quantitatively categorized to identify a person as being (1) “at-risk” for exercise dependency, (2) non-dependent symptomatic, or (3) non-dependent asymptomatic. “At-risk” individuals are those who score 15 or greater on 3 or more subscales. Non-dependent symptomatic individuals are those who score between 7 and 14 on 3 or more subscales and the “at risk” criterion is not met. Non-dependent asymptomatic individuals are those who score 6 or less on 4 or more subscales, assuming no other criteria are met (See Appendix B).

The EDS has been found to have adequate psychometric properties for both scoring methods. Hausenblas and Downs (2002b) conducted a series of studies in order to develop the EDS. In this series, they found the internal consistency to be good to excellent ($\alpha = .80, .94, .94, .95$). This was further supported by their study (2002c) which found the internal consistency scores for the subscales to be adequate to excellent ($\alpha$ range = .67-.93). The test-retest reliability is good, $r = .92$ (Hausenblas & Downs 2002b). The concurrent validity of the EDS was examined by comparing it to the Obligatory Exercise Questionnaire (OEQ) (Thompson & Pasma, 1991). An acceptable positive correlation ($r = .75, p < .05$) between the EDS and OEQ was observed (Hausenblas & Downs, 2002b).
Exercise Imagery Questionnaire (EIQ) The Exercise Imagery Questionnaire (Hausenblas et al., 1999) assesses types of imagery used during exercise. The EIQ consists of three subscales: Appearance, Technique, and Energy. Participants respond to each of the nine items by endorsing their level of imagery use on a nine-point rating scale anchored at the extremes with 1 = never to 9 = always. A higher score indicates greater imagery use (See Appendix C).

The EIQ has adequate psychometric properties. In previous research Cronbach’s alphas have demonstrated acceptable reliability for the EIQ subscales, with appearance ranging from .84-.87, energy ranging from .85-.90, and technique ranging from .86-.90 (Gammage et al., 2000; Hausenblas et al., 1999; Rodgers et al., 1999). Hausenblas and Downs (2002c) also determined that the internal consistency was good to excellent for the Appearance (α = .91), Technique (α = .88), and Energy (α = .88) subscales. The test-retest was also adequate (Rodgers et al., 1999 appearance r = .70, energy r = .74, technique r = .66). Previous research has also demonstrated that the EIQ is a valid instrument. Content and concurrent validity have been established (Gammage et al., 2000; Hausenblas et al., 1999; Rodgers et al., 1999).

Supplemental Questionnaire A supplemental questionnaire was included for the purpose of collecting demographic information as well as gathering information regarding the type and frequency of physical activity reported by the participants. Specifically, all participants were asked to provide their age, gender, ethnicity, education level, and the type of physical activity he/she participated in a typical week (See Appendix D). These activities included: NCAA Sport, College Sport Clubs (e.g.
rugby), Strength Training, Intramural/Recreational Sports, Aerobic/Dance Class, and/or Leisure Activity (visiting the gym, running, golf, yard work). Participants were also asked to estimate how many hours a week they exercise. Finally, the supplemental questionnaire asked the participants to indicate if they have ever been taught or instructed on how to use imagery as an aid to exercise.

**Procedures**

Permission to conduct this study was granted by Xavier University’s Institutional Review Board (IRB) (see Appendix E). The researcher contacted the professors and made arrangements to visit the classroom in order to have the students complete the study during the class period. A script introducing the study was read to recruit potential students (see Appendix F). Interested students were then provided with a handout explaining their rights to refuse or withdraw from the study, confidentiality, and the benefits and potential risks of the study (See Appendix G). They were then asked to proceed by completing the EDS, EIQ, and supplemental questionnaire. The EDS and EIQ were distributed in counterbalanced order, while the supplemental questionnaire was completed last. This entire process took approximately 15 minutes. In order to protect the student’s rights to confidentiality and anonymity, no identifying information was requested. It was assumed that volunteering to complete the surveys implied consent. The majority of participants were compensated with extra credit, per the professor’s discretion. It is believed that this reward system did not affect or bias the results in any manner.
Results

In order to determine if gender had a significant effect on exercise dependent symptoms, a one-way multivariate analysis of variance (MANOVA) was conducted with the seven EDS subscales (Tolerance, Withdraw Effects, Continuance, Lack of Control, Reductions in Other Activities, Time, and Intention) as the dependent variables and gender as the independent variable. A significant main effect was found (Wilks' Lambda = .935, $F(7,417) = 4.11, p<.05$), indicating males and females differ in the extent to which they demonstrate exercise dependent symptoms. Analyses of variances (ANOVA) on each dependent variable were conducted as follow-up tests to the MANOVA. The Bonferroni method was applied to control for Type I error, with each ANOVA tested at the .025 level. Follow-up analysis found that men scored significantly higher on the Time subscale $F(1,75) = 5.9, p<.01$ while women scored significantly higher on the Withdraw subscale $F(1,108) = 6.62, p<.01$ (see Table 2).

In order to determine if men and women differ on types of exercise imagery used, a one-way multivariate analysis of variance (MANOVA) was conducted with the three EIQ subscales (i.e. Technique, Appearance, Energy) as the dependent variables and gender as the independent variable. The MANOVA identified that gender does in fact have a significant overall effect on the EIQ subscales (Wilks' Lambda = .954, $F(3,422) = 6.73, p<.001$). However, when follow-up testing was completed by running separate ANOVA's on each dependent variable the univariate effects were not significant (see Table 3). It appears that gender has an overall effect on the EIQ subscales but does not have significant effect for any individual imagery type (i.e. Technique, Appearance, Energy).
A hierarchical multiple regression analysis was performed to examine the relationship between exercise dependency and exercise imagery for the entire sample, regardless of gender. This analysis included one set of predictors, measures of energy, technique, and appearance imagery. The criterion variable was the EDS total score. The means and standard deviations for the three predictor variables are found in Table 4. The linear combination of all imagery measures was significantly related to the EDS total score $F(3,423) = 98.34$, $p<.05$, indicating that the three types of exercise imagery are predictive of exercise dependency. A summary of the relative strengths for the individual predictors is presented in Table 5. Each of the IEQ subtests are also correlated (see Table 6). It is likely that there is some overlap among the subscales which may explain why all three imagery types were found to be predictive of exercise dependency.

Two additional hierarchical multiple regression analysis were run to examine the relationships between exercise dependency and exercise imagery for males and females separately. The criterion and predictor variables are consistent with the previous multiple regression analysis. For males, it was found that all measures of exercise imagery were significantly related to the EDS total score $F(3,192) = 53.39$, $p<.05$. Approximately 46% of the variance of the exercise dependent total score can be accounted for by the linear combination of exercise imagery measures. For females, it was found that energy imagery and technique imagery are predictive of exercise dependency symptoms. Appearance imagery was not found to be a significant predictor. Approximately 37% of the variance of the exercise dependent total score can be accounted for by the linear combination of exercise imagery measures for females. A summary of the relative
strengths for the individual predictors for both males and females are presented in Table 5.

A Chi-Square goodness of fit test with unequal proportions was performed to determine if there was a statistically significant difference between the percentage of participants who were observed to be “at risk” for exercise dependency, non-dependent symptomatic, and non-dependent asymptomatic as compared to Hausenblas and Downs’s (2002b) findings. The results of the Chi-Square were found to be significant \( \chi^2(2, N = 427) = 8.528, p<.01 \). The proportion of individuals found to be “at-risk” was significantly lower than Hausenblas and Downs’s findings (2002b). Consistent with Hausenblas and Downs’s findings (2002b), it was hypothesized that approximately 7% of the sample would be found to be “at-risk” for exercise dependency. However, this study found only 4% of the present sample (17 individuals) actually fell into this group. In contrast, the number of individuals who reported being non-dependent symptomatic of exercise dependency was significantly higher than Hausenblas and Downs’s findings. Based on their findings, this study proposed that approximately 55% of the sample (237 individuals) would fall into this category. This study found approximately 59% (250 individuals) of the sample was non-dependent symptomatic for exercise dependency.

Notably, the number of individuals who were found to be non-dependent asymptomatic was almost the exact same as Hausenblas and Downs’s findings. While they found 36% of their sample (157 individuals) to be non-dependent asymptomatic, this study found that 37% of the sample (160 individuals) fell into this category.

Finally, descriptive statistics were run on the sample. It was found that, on average, our participants reported spending approximately 6 (\( M=6.38, SD=5.77 \)) hours a
week exercising. However, approximately 4% of our sample reported themselves sedentary, not reporting any type of physical activity. Furthermore, about 27% of the college population reported exercising 3 or less hour per week. On the other end of the spectrum, less than 1% of the sample reported exercising over 30 hours per week. (see Table 1). More specifically, it was found that approximately 3.6% of undergraduate men report being sedentary, approximately 8.2% report exercising between fourteen and twenty hours per week, but none of the men reported exercising over 30 hours per week. For the women, approximately 4.3% consider themselves sedentary, 7.4% exercise between fourteen and twenty-eight hours per week, and approximately .04% exercise over 30 hours per week. See Table 8 for an even more detailed analysis.

In regard to specific groups, it was found that NCAA athletes report exercising about 15 hours per week, while the average amount of time spent exercising for non-NCAA athletes is about 5.5 hours per week. Furthermore, it was found that only 10 of the 36 non-NCAA athletes report exercising over twenty hours per week.

Exploratory analysis also examined the types of exercise that college students reported engaging in during a typically week. These activities ranged from being a NCAA athlete to visiting a fitness center or attending an aerobics class. Please see Table 8 for a more detailed breakdown. Finally, exploratory analysis determined that about 25% of the college population has received instruction on how to use imagery as an aid for exercise.

Discussion

The aim of present study was to explore the relationship among exercise dependency,
exercise imagery, and gender in a representative undergraduate population; meaning both active and sedentary individuals were asked to participate.

Gender & Exercise Dependency

The first hypothesis examined whether gender differences exist for symptoms of exercise dependency. The results indicate that males and females differ significantly on scores of exercise dependent symptoms. It was found that males scored significantly higher on the Time subscale than females indicating that men seek out and spend significantly more time in activities that are necessary to obtain exercise than women. It was also found that females scored significantly higher than males on the Withdraw subscale, suggesting that females are more likely to engage in exercise to avoid feeling irritable, anxious, or tense than males. The latter result differs from previous research which evidenced no gender difference on the Withdraw Effects subscale (Hausenblas & Downs 2002c). The discrepancy may be due to the fact the research included different sample populations. The current study included a more representative undergraduate sample, while Hausenblas and Downs’ (2002c) sample consisted of university students enrolled in sport and fitness classes. These differences may also be attributed to other factors such as the type of university from which the subjects were recruited (private vs. public) or differences in the type of coping skills used by persons in the different samples. Future exercise dependency research might attempt to replicate these findings.

Gender & Exercise Imagery

Due to the fact men and women appear to be motivated by different factors for exercise, it is also important to examine the relationship between gender and exercise imagery. Thus, the second null hypothesis stated that there is no statistically significant
overall gender effect for exercise imagery as measured by the EIQ subscale scores. The current study did find a significant overall MANOVA effect. However, when completing follow-up testing (ANOVA’s), no significant differences were found for the dependent variables. This can likely be attributed to the sample size, as the findings were approaching significance (see Table 3). Therefore, it is recommended that future research increase the sample size to determine if gender has a significant effect on the type of exercise imagery used. The overall significance may have diluted the ANOVA’s as the current study included both active and sedentary participants. It is likely that if the entire sample identified themselves as exercisers, similar to previous research, that significance would have been found.

Past research focusing on gender differences related to exercise imagery has been inconsistent. For example Gammage et al. (2000) found that men use technique imagery more than women, women use more appearance imagery than men, and no difference was evidenced for energy imagery. Hausenblas and Downs (2002c) found no difference for technique or appearance imagery, but did evidence a difference for energy imagery. The inconsistency in the research is likely due to the fact that different samples were included. Another factor that might contribute to the inconsistencies in research is the types of physical activities being represented. The current research included an undergraduate sample of students who ranged from physically active to sedentary, as well as, representing a variety of exercise modalities (i.e. running, aerobic classes, NCAA sport). Previous research, however, has only included physically active graduate and undergraduate students who were enrolled in sports and fitness classes (Hausenblas & Downs, 2002c) or individuals visiting fitness facilities (Gammage et al., 2000). Future
research might examine whether differences in exercise imagery use are related to the type, frequency, intensity, and duration of exercise (Hausenblas & Downs, 2002c).

**Exercise Dependency & Exercise Imagery**

An important component of exercise behavior is the underlying cognitions and motivations that promote the activity. The null hypothesis stated that exercise imagery, as measured by the EIQ, is not statistically predictive of exercise dependency as measured by the EDS total score. While previous research consistently found energy imagery to be predictive of exercise dependency, there have been discrepancies in the predictive value of technique and appearance imagery (Hausenblas & Downs, 2002c; Rodgers et al., 2001). The current study found that all three types of exercise imagery (i.e. appearance, technique, and energy) are predictive of exercise dependency, indicating that underlying motives for exercise dependency include: gaining energy or alleviating daily stress (energy imagery), images of perfecting skills and movements (technique imagery), and improving one’s physique (appearance imagery). Of note, technique and energy imagery were found to be stronger predictors of exercise dependency than appearance imagery (see Table 5). Therefore, it is possible that individuals who have symptoms of exercise dependency are more motivated by visions of alleviating daily stress, gaining energy, and improving their technique, than by visions of improving their appearance. Approximately 41% of the total variance can be accounted for by the measures of exercise imagery. Therefore, these findings can be viewed with some confidence.

Additional analyses were run to examine the relationship between exercise dependency and exercise imagery for both males and females. For males, it was found that all measures of exercise imagery were significantly related to the EDS total score.
This is somewhat surprising in light of the fact men are often assumed to exercise to feed their competitive nature (Biddle & Baily, 1985), and typically do not hold the stereotype that they are exercising to improve their body image. However, due to the fact society is currently preoccupied with health and a reverence for the body (Torre, 1995), it is possible that men are starting to become equally motivated by appearance as women.

For females, it was found that energy imagery and technique imagery are predictive of exercise dependency. Appearance imagery was not found to be a significant predictor. This finding is consistent with Rodgers et al. (2001) who found that energy and technique imagery, but not appearance imagery were associated with exercise dependency in female marathon runners. Again, this is a somewhat surprising finding given the fact women are often stereotyped to engage in exercise as a result of society’s pressure to appear ultra thin (Silberstein, et al., 1988). Future research may want to attempt and identify and explain this finding further.

Prevalence of Exercise Dependency

This study was also designed to provide information on the distribution of exercise dependency in a representative undergraduate college sample. There have been no identifiable studies to establish normative data stating the percentage of representative undergraduate students who fall into the groups: “at-risk,” non-dependent symptomatic, and non-dependent asymptomatic for exercise dependency. As part of the development of the EDS, Hausenblas and Downs (2002b) conducted a series of investigate studies using only physically active university students and determined that nearly 7% of the university students were “at-risk” for exercise dependency, about 55% were non-dependent symptomatic, and 36% were non-dependent asymptomatic. However, these researchers
concluded that in a more general population, the percentage of individuals found to be “at-risk” for exercise dependency would be significantly less given the small percentage of adults who participate in regular exercise. In contrast, Zmijewski and Howard (2003) attempted to examine the prevalence of exercise-dependence symptoms among 237 college undergraduates but failed to report actual percentages. They simply stated that “symptoms of exercise dependence were common” (Zmijewski and Howard, 2003, p. 194). Furthermore, they concluded that “exercise dependency may be much more prevalent than previously thought, especially in young adult populations” (Zmijewski and Howard, 2003, p. 194). As a result of these apparent inconsistencies, more research is needed about the distribution of exercise dependency in a general college population. The present study hypothesized that the sample distribution for exercise dependency would not differ significantly from: 7% categorized as “at-risk”, 55% categorized as non-dependent symptomatic, and 36% as non-dependent asymptomatic.

As Hausenblas and Downs (2002b) proposed, in a population including both active and sedentary individuals, the percentage of people found to be “at-risk” for exercise dependency was significantly less than expected. For this study, only 4% (17 individuals) of the sample actually fell into the “at-risk” category. Perhaps if sedentary individuals were excluded from the present sample there would not have been a discrepancy between the current and past findings. In contrast, the number of individuals who reported being non-dependent symptomatic of exercise dependency was significantly higher than expected. While this study hypothesized that 55% of the sample (237 individuals) would fall into this category, approximately 59% (250 individuals) were found to be non-dependent symptomatic for exercise dependency. Notably, the
number of individuals who were found to be non-dependent asymptomatic was as expected. The present study found that approximately 37% of the sample (160 individuals) was non-dependent asymptomatic, which is similar to the proposed 36% (157 individuals). In summary, it appears that the percentage of undergraduate students who are “at-risk” for exercise dependency is relatively low. However, over half of the college sample reported being non-dependent symptomatic of exercise dependency which is noteworthy since exacerbation of these symptoms might lead to the individual becoming “at-risk” for exercise dependency. More research is needed to clarify this issue.

**Frequency and Types of Exercise**

Due to the fact exercise dependency is a fairly new area of research there are interesting questions that have not been addressed. For example, one relationship that is often overlooked is the frequency of exercise as related to exercise dependency. In a post-hoc analysis, based on the highest 10 percent of the sample for frequency of exercise, students who reported exercising at least 14 hours per week, it was found that 23 percent of this group was “at-risk” for exercise dependency. In contrast, 3.9 percent of the sample who reported exercising between 7 and 14 hours per week endorsed being “at-risk” for exercise dependency, while only 0.7% of individuals reporting exercising 6 or less hours per week fell into the “at risk” category. On the surface, these results indicate that individuals who exercise more frequently are at higher risk for exercise dependent symptoms. Future research may want to look into the relationship of these two factors.

An additional analysis also examined the frequency of exercise reported by the seventeen individuals who were found to be “at-risk” for exercise dependency. It was found that three of these individuals reported exercising four to seven hours per week,
four individuals reported exercising eight to thirteen hours per week, and ten reported exercising fourteen to twenty-eight hours per week.

Another relationship that has not been addressed by past research is how exercise dependency may be related to the fact one is an NCAA athlete. On a post-hoc basis it was found that 22% of the NCAA athletes endorsed being “at-risk” for exercise dependency, while only 2.3% of non-NCAA students were found to be “at-risk.” Thus, this finding suggests that NCAA athletes are at greater risk for developing symptoms of exercise dependency than non-NCAA athletes. If this finding is supported by future research, it could have practical implications for NCAA athletes. Specifically, one finding, if replicated, suggests that NCAA athletes’ are at higher risk for developing psychological and physical problems as a result of exercise compared to student who are not NCAA athletes. Another possible explanation is that exercise serves different psychological purposes for NCAA athletes which the EDS is not sensitive to, thereby negating the interpretation of the EDS scales scores results. Future research will hopefully clarify these matters.

Future Research

There are a few theoretical controversies that researchers should be aware of when studying exercise dependency. One theoretical issue centers on the appropriateness of modeling exercise dependency after the DSM-IV criteria for substance abuse (Zmijewski & Howard, 2003). Based on the DSM-IV substance abuse criteria, exercise dependency has been defined as “a multidimensional maladaptive pattern of exercise, leading to clinically significant impairment or distress” in several areas of functioning (Hausenblas & Downs, 2002b, p. 391). (see Appendix A) The fact that this definition is
based on DSM-IV diagnostic criterion implies that some researchers view exercise dependency as a possible mental disorder, suggesting that exercise dependency represents a symptom of psychopathology that interferes with everyday functioning. As a result, there is a significant need for future research to examine whether or not exercise dependency actually reflects psychopathology in some way and interferes with daily functioning (Zmijewski & Howard, 2003). Specifically, research should be designed to determine "what extent exercise dependence is a valid clinical construct and where one would draw the line between healthful and deleterious exercise behavior" (Zmijewski & Howard, 2003, p. 194). For example, one may assume that an individual who chooses to spend the majority of his/her time exercising as having a problem because it may interfere with daily life such as spending time with family or effecting occupational responsibilities. However, when looking at the results of the current study it was found in a post-hoc analysis that approximately 23 percent of the individuals who exercise over fourteen hours per week were "at risk" for exercise dependency. Therefore, about 77 percent of the individuals who exercise fourteen or more hours per week did not report dependency. As a result, it should not be assumed that someone who spends a significant amount of time exercising is at high risk for exercise dependency. Future research should strive to demonstrate how the clinical symptoms included in the definition of exercise dependency negatively impact daily functioning and psychological well-being. This could be accomplished by conducting follow-up interviews with individuals who were found to be "at-risk" for exercise dependency.

Another theoretical controversy focuses on whether or not exercise dependency (i.e. primary dependency) can exist independent of an eating disorder (Keski-Rahkonen, 2003).
2000; Thomas & Pasma, 1991; Zmijewski & Howard, 2003). Specifically, there is a distinction made regarding “primary exercise dependency” and “secondary exercise dependency.” The two can be distinguished by identifying the underlying motivation that drives exercise. For example, in “primary exercise dependency”, exercise is the motivating force behind the activity. Individuals view exercise as rewarding in itself, and are not motivated by secondary gain such as weight loss. In primary exercise dependency, weight control and dieting are used to enhance performance and are not the main motivating forces behind the activity (DeCoverly Veale, 1987). In contrast, “secondary dependency” is defined as occurring in conjunction with an eating disorder and the underlying motive for exercise is to improve and control one’s body image (Szabo, 2000). In order to address this theoretical issue, it is important for future research to control for the effects of eating disorders. This could be accomplished by including an eating disorder screening measure or conducting a clinical interview in order to collect appropriate background information. The present study did not control for eating disorders. As a result, individuals who were found to be “at-risk” for exercise dependency might represent secondary exercise dependency rather than primary dependency. However, given the fact that this study found technique and energy imagery to be stronger predictors of exercise dependency than appearance imagery it appears more likely that primary exercise dependency was the construct being measured.

There are several limitations that should be kept in mind when interpreting the findings. First, the statistical design of this study was quasi-experimental in nature, and therefore, prevents causality from being established. Experimental and longitudinal studies are needed to further the understanding of exercise dependency.
Second, the measures included were self-report measures that assessed past behaviors. As a result, there could be some distortions existing in the responses provided. In order to avoid possible distortions, future researchers may want to ask participants to keep a journal of exercise behaviors (i.e. frequency, motives) rather than asking for estimates or answers based on past memories.

Third, the participants for this study were recruited from a mid-western, private university limiting the generalizability of these findings. For example, approximately 83% of the sample is comprised of individuals who identify themselves as Caucasian. Also, women were represented slightly (196 males, 229 females) more than men. Future research should aim to collect data from other representative college samples as well as from more diverse populations.

A fourth limitation to this study is that the researcher only evaluated the cognitive variable of imagery as a motivating factor underlying exercise and did not include other motivating factors such as self-regulation. Self regulation has been defined as “those processes, internal and/or transactional, that enable an individual to guide his/her goal-directed activities over time and across changing circumstances” (Behncke, 2006, p. 2). In other words, self-regulations involves engaging in certain behaviors, such as goal setting, self-monitoring, and self-evaluation, that guide one’s behavior and helps the individual achieve their goal (Behncke, 2006). This study did not examine or control for the effects of self-regulation in this study. As a result, future studies may want to control or examine these factors to determine if they have an impact on exercise dependency.

Finally, while improved body image, enhanced technique, and increased energy are all motivating factors underlying exercise there are also many other factors that
influence this behavior. For example, many of the individuals included in this study
identified themselves as NCAA athletes. As a result, these individuals may be primarily
motivated by financial incentives (i.e. scholarships) or by team encouragement as
opposed to the motivations listed above. In addition, these individuals tend to spend more
time exercising than their peers.
References


http://www.who.int/hpr/physactiv/health.benefits.shtml

Table 1

**Supplemental Data: Percentage of Participants According to Education, Ethnicity, Activity Type, & Imagery Instruction**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Percentage of Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>110</td>
<td>25.6</td>
</tr>
<tr>
<td>Sophomore</td>
<td>105</td>
<td>24.6</td>
</tr>
<tr>
<td>Junior</td>
<td>135</td>
<td>31.5</td>
</tr>
<tr>
<td>Senior</td>
<td>76</td>
<td>17.7</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
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<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>360</td>
<td>83.9</td>
</tr>
<tr>
<td>Asian</td>
<td>9</td>
<td>2.1</td>
</tr>
<tr>
<td>Native American</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>African American</td>
<td>35</td>
<td>8.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>12</td>
<td>2.8</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Activity Type</strong></td>
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<td></td>
</tr>
<tr>
<td>NCAA Sport</td>
<td>36</td>
<td>8.4</td>
</tr>
<tr>
<td>Sport Club (i.e. rugby)</td>
<td>52</td>
<td>12.1</td>
</tr>
<tr>
<td>Strength Training (i.e. lifting)</td>
<td>97</td>
<td>22.6</td>
</tr>
<tr>
<td>Intramural/Recreational Sports (i.e. softball, pick up b-ball games)</td>
<td>147</td>
<td>34.3</td>
</tr>
<tr>
<td>Aerobic/Dance Classes</td>
<td>38</td>
<td>8.9</td>
</tr>
<tr>
<td>Leisure Exercise (i.e. visiting gym, biking, walking, golf, yard work)</td>
<td>308</td>
<td>71.0</td>
</tr>
<tr>
<td>Other</td>
<td>34</td>
<td>7.9</td>
</tr>
<tr>
<td>None</td>
<td>26</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Frequency of Exercise (Hours/Wk)</strong></td>
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<td></td>
</tr>
<tr>
<td>0</td>
<td>17</td>
<td>4.0</td>
</tr>
<tr>
<td>1-3</td>
<td>117</td>
<td>27.5</td>
</tr>
<tr>
<td>4-7</td>
<td>171</td>
<td>40.1</td>
</tr>
<tr>
<td>8-13</td>
<td>78</td>
<td>18.3</td>
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<tr>
<td>14-28</td>
<td>41</td>
<td>9.6</td>
</tr>
<tr>
<td>30-60</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Imagery Instruction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>107</td>
<td>24.9</td>
</tr>
<tr>
<td>No</td>
<td>319</td>
<td>74.4</td>
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</table>
Table 2

*Significant Effects of Gender on Symptoms of Exercise Dependency:*

*Results of the one-way multivariate analysis of variance*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>F</th>
<th>DF</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS Subscales</td>
<td>4.109</td>
<td>7</td>
<td>.000**</td>
</tr>
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</table>

*Univariate Comparison of Gender on Symptoms of Exercise Dependency*

<table>
<thead>
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<th>Predictor</th>
<th>F</th>
<th>DF</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdraw</td>
<td>6.620</td>
<td>1</td>
<td>.010**</td>
</tr>
<tr>
<td>Control</td>
<td>.064</td>
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<td>.800</td>
</tr>
<tr>
<td>Tolerance</td>
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<td>.452</td>
</tr>
<tr>
<td>Lack</td>
<td>.016</td>
<td>1</td>
<td>.901</td>
</tr>
<tr>
<td>Reduction</td>
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<td>1</td>
<td>.121</td>
</tr>
<tr>
<td>Time</td>
<td>5.896</td>
<td>1</td>
<td>.016**</td>
</tr>
<tr>
<td>Intention</td>
<td>3.536</td>
<td>1</td>
<td>.061</td>
</tr>
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</table>
Table 3

**Significant Effects of Gender on Exercise Imagery**

Results of the one-way multivariate analysis of variance

<table>
<thead>
<tr>
<th>Predictor</th>
<th>F</th>
<th>DF</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIQ Subscales</td>
<td>6.733</td>
<td>3</td>
<td>.001**</td>
</tr>
</tbody>
</table>

Univariate Comparison of Gender on Symptoms of Exercise Dependency

<table>
<thead>
<tr>
<th>Predictor</th>
<th>F</th>
<th>DF</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIQ Energy</td>
<td>3.692</td>
<td>1</td>
<td>p = .055</td>
</tr>
<tr>
<td>EIQ Technique</td>
<td>3.773</td>
<td>1</td>
<td>p = .053</td>
</tr>
<tr>
<td>EIQ Appearance</td>
<td>3.700</td>
<td>1</td>
<td>p = .055</td>
</tr>
</tbody>
</table>
Table 4

**Means and Standard Deviations for Exercise Imagery Scores**

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIQ Energy</td>
<td>9.10</td>
<td>5.434</td>
</tr>
<tr>
<td>EIQ Appearance</td>
<td>18.73</td>
<td>6.615</td>
</tr>
<tr>
<td>EIQ Technique</td>
<td>13.74</td>
<td>6.764</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIQ Energy</td>
<td>9.67</td>
<td>5.476</td>
</tr>
<tr>
<td>EIQ Appearance</td>
<td>18.06</td>
<td>6.649</td>
</tr>
<tr>
<td>EIQ Technique</td>
<td>14.46</td>
<td>6.862</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIQ Energy</td>
<td>8.64</td>
<td>5.373</td>
</tr>
<tr>
<td>EIQ Appearance</td>
<td>19.29</td>
<td>6.575</td>
</tr>
<tr>
<td>EIQ Technique</td>
<td>13.16</td>
<td>6.638</td>
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</table>

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Table 5

Multiple Regressions for Gender and Combined Groups for Exercise Dependency and Exercise Imagery

<table>
<thead>
<tr>
<th>Predictor</th>
<th>F</th>
<th>Df</th>
<th>Beta</th>
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<tbody>
<tr>
<td>All</td>
<td>98.335**</td>
<td>3,423</td>
<td>.406**</td>
</tr>
<tr>
<td>EIQE</td>
<td></td>
<td></td>
<td>.115 *</td>
</tr>
<tr>
<td>EIQA</td>
<td></td>
<td></td>
<td>.228**</td>
</tr>
<tr>
<td>EIQT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>53.386**</td>
<td>3,192</td>
<td>.347**</td>
</tr>
<tr>
<td>EIQE</td>
<td></td>
<td></td>
<td>.145*</td>
</tr>
<tr>
<td>EIQA</td>
<td></td>
<td></td>
<td>.303**</td>
</tr>
<tr>
<td>EIQT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>47.160**</td>
<td>3,225</td>
<td>.456**</td>
</tr>
<tr>
<td>EIQE</td>
<td></td>
<td></td>
<td>.086</td>
</tr>
<tr>
<td>EIQA</td>
<td></td>
<td></td>
<td>.168*</td>
</tr>
<tr>
<td>EIQT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6

Correlation among the Exercise Imagery Questionnaire Subtests

<table>
<thead>
<tr>
<th></th>
<th>EIQ Energy</th>
<th>EIQ Appearance</th>
<th>EIQ Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIQ Energy</td>
<td>1</td>
<td>.40**</td>
<td>.61**</td>
</tr>
<tr>
<td>EIQ Appearance</td>
<td>.40**</td>
<td>1</td>
<td>.59**</td>
</tr>
<tr>
<td>EIQ Technique</td>
<td>.61**</td>
<td>.59**</td>
<td>1</td>
</tr>
</tbody>
</table>

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### Table 7

**Gender and Reported Frequency of Exercise (Hours/Week)**

<table>
<thead>
<tr>
<th>Group</th>
<th>Reported Hours/Week</th>
<th>N</th>
<th>Percentage of Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>7</td>
<td>3.6</td>
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<td>1-3</td>
<td></td>
<td>39</td>
<td>19.4</td>
</tr>
<tr>
<td>4-7</td>
<td></td>
<td>81</td>
<td>37.8</td>
</tr>
<tr>
<td>8-13</td>
<td></td>
<td>47</td>
<td>23.5</td>
</tr>
<tr>
<td>14-28</td>
<td></td>
<td>22</td>
<td>8.2</td>
</tr>
<tr>
<td>30-60</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>10</td>
<td>4.3</td>
</tr>
<tr>
<td>1-3</td>
<td></td>
<td>78</td>
<td>32.6</td>
</tr>
<tr>
<td>4-7</td>
<td></td>
<td>90</td>
<td>50.0</td>
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<tr>
<td>8-13</td>
<td></td>
<td>31</td>
<td>12.2</td>
</tr>
<tr>
<td>14-28</td>
<td></td>
<td>19</td>
<td>7.4</td>
</tr>
<tr>
<td>30-60</td>
<td></td>
<td>2</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Table 8

**Gender and Reported Types of Exercise**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Percentage of Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCAA Sport</td>
<td>17</td>
<td>8.7</td>
</tr>
<tr>
<td>Sport Club (i.e. rugby)</td>
<td>32</td>
<td>16.3</td>
</tr>
<tr>
<td>Strength Training (i.e. lifting)</td>
<td>62</td>
<td>31.6</td>
</tr>
<tr>
<td>Intramural/Recreational Sports (i.e. softball, pick up b-ball games)</td>
<td>99</td>
<td>50.5</td>
</tr>
<tr>
<td>Aerobic/Dance Classes</td>
<td>5</td>
<td>2.6</td>
</tr>
<tr>
<td>Leisure Exercise (i.e. visiting gym, biking, walking, golf, yard work)</td>
<td>127</td>
<td>64.8</td>
</tr>
<tr>
<td>Other</td>
<td>18</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCAA Sport</td>
<td>19</td>
<td>8.3</td>
</tr>
<tr>
<td>Sport Club (i.e. rugby)</td>
<td>20</td>
<td>8.7</td>
</tr>
<tr>
<td>Strength Training (i.e. lifting)</td>
<td>35</td>
<td>15.2</td>
</tr>
<tr>
<td>Intramural/Recreational Sports (i.e. softball, pick up b-ball games)</td>
<td>48</td>
<td>20.9</td>
</tr>
<tr>
<td>Aerobic/Dance Classes</td>
<td>33</td>
<td>14.3</td>
</tr>
<tr>
<td>Leisure Exercise (i.e. visiting gym, biking, walking, golf, yard work)</td>
<td>181</td>
<td>78.7</td>
</tr>
<tr>
<td>Other</td>
<td>16</td>
<td>7.0</td>
</tr>
</tbody>
</table>

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Appendix A

Proposed DSM-IV diagnostic criteria of exercise dependency

(Hausenblas & Downs, 2002a).
Appendix A

A multidimensional maladaptive pattern of exercise, leading to clinically significant impairment or distress, as manifested by three or more of the following:

1) **tolerance**: which is defined as either a need for significantly increased amounts of exercise to achieve the desired effect or diminished effect with continued use of the same amount of exercise

2) **withdrawal**: as manifested by either withdrawal symptoms for exercise (e.g. anxiety, fatigue) or the same (or closely related) amount of exercise is taken to relieve or avoid withdrawal symptoms

3) **intention effects**: exercise is often taken in larger amounts or over a longer period than was intended

4) **loss of control**: there is a persistent desire or unsuccessful efforts to cut down or control exercise

5) **time**: a great deal of time is spent in activities necessary to obtain exercise (e.g. vacations are exercise related)

6) **conflict**: important social, occupation, or recreational activities are given up or reduced because of exercise

7) **continuance**: exercise is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by exercise (e.g. continued running despite severe shin splits).
Appendix B

The Exercise Dependency Scale, including instructions, questions, and subscales.
Appendix B

Instructions: Using the scale provided below, please complete the following questions as honestly as possible. The questions refer to current exercise beliefs and behaviors that have occurred in the past 3 months. Please circle the number on the scale provided from one (never) to six (always). If you do not consider yourself an exerciser, please circle number 1 for all items. Do not leave any questions blank.

<table>
<thead>
<tr>
<th>(1) Never</th>
<th>(6) Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I exercise to avoid feeling irritable.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>2. I exercise despite recurring physical problems.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>3. I continually increase my exercise intensity to achieve the desired effects/benefits.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>4. I am unable to reduce how long I exercise.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>5. I would rather exercise than spend time with family/friends.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>6. I spend a lot of time exercising.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>7. I exercise longer than I intend.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>8. I exercise to avoid feeling anxious.</td>
<td>6 5 4 3 2 1</td>
</tr>
<tr>
<td>9. I exercise when injured.</td>
<td>6 5 4 3 2 1</td>
</tr>
</tbody>
</table>

Please proceed to the next page
<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>I continually increase my exercise frequency to achieve desired effects/benefits.</td>
<td>1</td>
</tr>
<tr>
<td>11.</td>
<td>I am unable to reduce how often I exercise.</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>I think about exercise when I should be concentrating on school/work.</td>
<td>1</td>
</tr>
<tr>
<td>13.</td>
<td>I spend most of my free time exercising.</td>
<td>1</td>
</tr>
<tr>
<td>14.</td>
<td>I exercise longer than I expect.</td>
<td>1</td>
</tr>
<tr>
<td>15.</td>
<td>I exercise to avoid feeling tense.</td>
<td>1</td>
</tr>
<tr>
<td>16.</td>
<td>I exercise despite persistent physical problems.</td>
<td>1</td>
</tr>
<tr>
<td>17.</td>
<td>I continually increase my exercise duration to achieve the desired effects/benefits.</td>
<td>1</td>
</tr>
<tr>
<td>18.</td>
<td>I am unable to reduce how intense I exercise.</td>
<td>1</td>
</tr>
<tr>
<td>19.</td>
<td>I choose to exercise so that I can get out of spending time with family/friends.</td>
<td>1</td>
</tr>
<tr>
<td>20.</td>
<td>A great deal of my time is spent exercising.</td>
<td>1</td>
</tr>
<tr>
<td>21.</td>
<td>I exercise longer than I plan.</td>
<td>1</td>
</tr>
</tbody>
</table>

Subscale Breakdown:
<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdrawal Effects</td>
<td>1,8,15</td>
</tr>
<tr>
<td>Continuance</td>
<td>2,9,16</td>
</tr>
<tr>
<td>Tolerance</td>
<td>3,10,17</td>
</tr>
<tr>
<td>Lack of Control</td>
<td>4,11,18</td>
</tr>
<tr>
<td>Reduction in Other Activities</td>
<td>5,12,19</td>
</tr>
<tr>
<td>Time</td>
<td>6,13,20</td>
</tr>
<tr>
<td>Intention Effects</td>
<td>7,14,21</td>
</tr>
</tbody>
</table>

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Appendix C

The Exercise Imagery Questionnaire, including a description of exercise imagery, instructions, questionnaires, and subscales.
Description:
Imagery involves mentally seeing yourself exercising. The image in your mind should approximate the actual physical activity as closely as possible. Imagery may include sensations like hearing the aerobic music and feeling yourself move through the exercises. Imagery can also be associated with emotions (e.g. getting psyched up or energized), techniques/strategies (e.g. form or pacing) and/or setting goals (e.g. losing weight).

Instructions: Using the scale provided below, please complete the following questions as honestly as possible. The questions refer to the use of exercise imagery that have occurred in the past 3 months. Please circle the number on the scale provided below, one (never) to nine (always), to indicate the amount you engage in the listed behavior. If you do not consider yourself an exerciser, please circle number 1 for all items. Do not leave any questions blank.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Always</td>
</tr>
<tr>
<td>1.</td>
<td>To keep me going during the day I imagine exercising.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>2.</td>
<td>I imagine a “fitter-me” from exercising.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>3.</td>
<td>To take my mind off my work, I imagine exercising.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>4.</td>
<td>When I think about exercising, I imagine perfecting my technique.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>5.</td>
<td>When I think about exercising, I imagine my form and body position.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>6.</td>
<td>To get me energized, I imagine exercising.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
<tr>
<td>7.</td>
<td>I imagine a “leaner-me” from exercising.</td>
<td>1 2 3 4 5 6 7 8 9</td>
</tr>
</tbody>
</table>

Please proceed to the next page
8. I imagine a "firmer-me" from exercising.

     1  2  3  4  5  6  7  8  9

9. When I think about exercising, I imagine doing the required movements.

     1  2  3  4  5  6  7  8  9

Subscale Breakdown:

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Item Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance Imagery</td>
<td>2, 7, 8</td>
</tr>
<tr>
<td>Energy Imagery</td>
<td>1, 3, 6</td>
</tr>
<tr>
<td>Technique Imagery</td>
<td>4, 5, 9</td>
</tr>
</tbody>
</table>
Appendix D

Supplemental Questionnaire
Appendix D

1. **Age:** ______

2. **Gender:** (please circle):
   - Male
   - Female

3. **Ethnicity** (please circle):
   - Caucasian
   - African American
   - Asian
   - Hispanic
   - Native American
   - Other: _________________

4. **Education** (please circle):
   What is your current level of education at Xavier University (please circle):
   - Freshman
   - Sophomore
   - Junior
   - Senior

5. **Activity type** (please circle all that apply):
   In a typical week, I usually participate in the following activities:
   - NCAA Sports
   - Intramural/Recreational Sports (e.g. softball, pick up games)
   - College Sport Clubs (e.g. rugby)
   - Aerobic/Dance Class
   - Strength Training
   - "Standard" Exercise (visiting the gym or fitness center, walking, running, biking, golf, yard work)
   - Other: _________________

6. **Approximately how many hours in a typical week do you exercise?** 
   ______

7. **Imagery:** Have you ever been taught or instructed how to use imagery as an aid in your exercise? (Please circle):
   - Yes
   - No
Appendix E

IRB Permission Letter
August 11, 2004
Raegan Radenheimer, M.A.,
90-8 Creekwood Drive Wilder,
KY 41071

Dear Ms. Radenheimer:

The IRB received your protocol #0301-1, Exercise Dependency, Exercise Imagery, and Gender in an Undergraduate Population, on August 10, 2004 and your revised informed consent on August 11. The suggested changes have been made to your informed consent and your research is approved in the Exempt category. No further reporting is required unless your protocol is modified or adverse events occur.

Enclosed is your Informed Consent document with XU IRB's approval stamp.

We wish you every success in your research.

Sincerely,

Robert C. Baumiller, SJ.
Chair and Administrator

RCB:mn

cc: Dr. David Hellkamp
Appendix F

Introduction Script
Appendix F

Introduction Script

My name is Raegan Radenheimer and I am a graduate student in the Clinical Psychology Program here at Xavier University. As part of the program, it is required that we complete a large research project typically known as a dissertation. I am here today to ask each of you to help me fulfill this requirement by participating in my research study. My study focuses on exercise behaviors and underlying behaviors related to exercise. You do not have to be an exerciser or participate in regular exercise to participate. Anyone is eligible to participate. The study consists of filling out three surveys. It is important that you complete all items including the demographics questionnaire. All information provided is anonymous as I will not be asking for your name. So, please do not place your name on any of the materials. It will take approximately 10 minutes to complete the surveys. I would really appreciate your time and participation in my study. Please read over the consent form in order to decide if you would like to participate. If you agree to participate please continue by reading the instructions and then completing the surveys.

Thank you!!!
Appendix G

Instructions to potential participants and the consent to participate form.
Appendix G

Instructions to Potential Participants

This packet contains a number of questions related to exercise behaviors and underlying motivations for physical activity. These questions can be answered by ANYONE. You do NOT need to engage in regular exercise to participate in this study. The form entitled "Consent to Participate" further explains this study. Please look over it before deciding whether or not you would like to participate.

After you read over the consent form, and if you decide to continue, please complete all materials as openly and honestly as possible. Do not leave any questions blank. When you are finished keep the "Consent to Participate" form and return all of the materials to the researcher. If you decided not to participate, simply return your packet to the researcher.

Thank you.
Consent to Participate

I agree to take part in this study conducted by Raegan Radenheimer, M.A. at Xavier University. This study examines the relationship between exercise behaviors and exercise imagery among undergraduate college students. The time commitment for the study ranges from 10 to 15 minutes.

You have been asked to participate because you are currently enrolled in Xavier University’s core curriculum undergraduate courses. This study is open to all individuals, ranging from individuals who do not exercise at all to those who exercise on a regular basis.

I understand that my participation will involve completing three separate surveys and that in doing so my consent is implied. I have been instructed not to place my name or any other identifying information on the surveys. I know my name and responses to this study are completely confidential. Reports of the results will be reported in group formats. No individual names or scores will be identified.

I understand there is no direct benefit for me participating in this study. I will not receive any financial compensation, though some students may receive extra credit, per the professor’s discretion. However, by participating, I am providing information to further research in the realm of exercise behavior. There are no foreseeable risks associated with completing these surveys. While it is not possible to identify all potential risks in an experimental procedure, reasonable safeguards have been taken to minimize both the known and potential unknown risks.

I understand that participation in this study is completely voluntary and I may choose to cease participation at any time without penalty. Refusal to take part in this study will have NO effect on any future services I may be entitled to from the University.

If you have any questions about this project, Raegan Radenheimer, can be reached at 859-992-5018. Her research is supervised by David Hellkamp, Ph.D., who can be reached at 513-745-1044.

Thank you for your time and cooperation. Please keep this Consent to Participate form for possible future reference.