An investigation of preferred versus imposed exercise, personality traits, and motivation on an exercise dependent college aged sample

Chelsea M. Norton

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An Investigation of Preferred versus Imposed Exercise, Personality Traits, and Motivation on an Exercise Dependent College Aged Sample

by

Chelsea M. Norton

A thesis submitted to the graduate faculty in partial fulfillment of the requirements for the degree of Master of Science in Exercise Science

Kinesiology Department

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ABSTRACT

The purpose of this study was to: (a) investigate personality traits and motivation among an exercise dependent sample by using and examining theoretically based assessment tools and (b) measure feeling states under different types of physical activity among those who were considered to be exercise dependent. Four hundred twenty-three college students (54.4% male, 45.6% female) who met the inclusion criteria completed the Exercise Dependence Scale-Revised (EDS-R; Symons Downs, Hausenblas, & Nigg, 2004), Exercise Addiction Inventory (EAI; Terry, Szabó, & Griffiths, 2004), Exercise Identity Scale (EIS; Anderson & Cychosz, 1994), Behavioral Regulations in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004), and Preference for and Tolerance of Intensity of Exercise Questionnaire (PRETIE-Q; Ekkekakis, Hall, & Petruzzello, 2005). The results of the first part of the study indicated that there was an association between the categories provided by the EDS-R and the EAI; as well as an association between the subscales of the BREQ-2 and the EDS-R and the EAI. Results also indicated that the full model of scores on the EIS, BREQ-2, and PRETIE-Q significantly contributed to the prediction of category membership for both the EDS-R and the EAI. The follow up part of the study included a small sample (n = 5) of exercise dependent participants who engaged in a randomly assigned schedule of their preferred, an assigned, or no exercise modality over a one-week period. Participants completed the Exercise-induced Feeling Inventory (EFI; Gauvin & Rejeski, 1993) four times during each day. These results indicated that physical exhaustion did not change across the conditions, while positive feeling states were highest during their preferred exercise modality with no differences between the no workout and assigned workout conditions. The results provide
support for (a) personality traits and motivational factors having an influence on a person becoming high risk for exercise dependency and for (b) the possibility of certain types of physical activity eliciting higher positive feeling responses compared to others.
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CHAPTER 1
OVERVIEW

Introduction

Physical activity is a complex behavior that constitutes a spectrum. At one end of the spectrum, physical inactivity remains a critical worldwide problem and is believed to be a main cause of a number of non-communicable diseases (Lee et al., 2012). It has been recommended that people maintain a certain level of physical activity in order to prevent disease and preserve overall quality of life, which acts as a middle ground on the spectrum of physical activity (Centers for Disease Control [CDC], 2011). However, toward the opposite side of the spectrum, when a person begins to take part in physical activity in excess they may begin to experience negative consequences. Considerable attention has been given to physical inactivity. However, the idea that a person may engage in exercise to the point that it may interfere with their health and daily life is a relatively new phenomenon and lacks understanding (Kerr, Lindner, & Blaydon, 2007).

The phenomenon of exercising in excess is a concept that crosses over many disciplines including: psychology, exercise science, and medicine. As such, many terms used to describe this complex behavior exist. Despite increasing interest in this behavior, a definitive term has yet to be established (Berczik et al., 2012). For the sake of consistency, the term exercise dependency will be used throughout this paper.

Exercise dependency has been generally defined as physical activity that is severe in occurrence and length, resilient to change, and is often linked to an uncontrollable desire to continue exercise in spite of injury, illness, fatigue, or other personal responsibilities (Hausenblas & Symons Downs, 2002)
Much of the research on exercise dependency has involved trying to develop and improve ways of measuring and assessing the condition. Additional research has investigated possible mechanisms that may contribute to exercise dependency. These proposed mechanisms include, physiological, social, psychological, and environmental aspects. However, results remain inconclusive and, therefore, further research continues to be a priority (Berczik et al., 2012).

**Statement of the Problem**

The purposes of this study were (a) to examine the relationships between two measures of exercise dependence with measures of personality traits, self-identity with relation to exercise, and motivational regulations among an exercise dependent sample and (b) to measure feeling states under different types of physical activity among those who are considered to be at risk for exercise dependency.

**Significance of the Study**

Through the use of the Preference for and Tolerance of Exercise Intensity Questionnaire (PRETIE-Q), Exercise Identity Scale (EIS), and Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2), the study has aimed to further clarify exercise dependency by identifying possible factors that may influence this phenomenon. Exercise has the effect of altering feeling states in the positive direction, and in doing so, produces the “feel good” phenomenon often associated with exercise (Reed & Ones, 2006). This positive change has been argued to be more pronounced in a person who is considered to be exercise dependent (Mello, Negrão, Rosa, & Souza-Formigoni, 2004). However, to date there have been no studies investigating the alteration of feeling states of people who
are considered at high risk for exercise dependency while manipulating the type of exercise performed.

**Research Hypotheses**

a) There would be significant associations between the scores on the EAI and the EDS-R with the EIS, PRETIE-Q, and the BREQ-2.

   i. There would be a significant positive association between those who are considered at high risk for exercise dependency and exercise identity.

   ii. There would be a significant positive association between those who are considered at high risk for exercise dependency and scores on the PRETIE-Q.

   iii. There would be a significant positive association between those who score higher in the identified regulation and intrinsic regulation on the BREQ-2 and are considered at high risk for exercise dependency.

b) There would be a change in feeling states across the three conditions; preferred activity, assigned activity, and no activity.

   i. There would be an increase in positive feeling states with preferred activity versus no activity.

   ii. There would be an increase in positive feeling states with preferred versus an assigned activity.

   iii. There would be an increase in positive feeling states with assigned versus no activity.

**Delimitations**

Part A of the study was delimited to (a) male and female college-aged students who were (b) currently enrolled in classes at SUNY-Cortland, as well as the measures of
(c) Exercise Dependent Scale-Revised, (d) Exercise Addiction Inventory, (e) Exercise Identify Scale, (f) Behavioral Regulations in Exercise Questionnaire-2, and (g) Preference for and Tolerance of Intensity of Exercise Questionnaire. Part B of the study was delimited to those who (a) completed Part A of the study that were (b) apparently healthy and non-smokers, (c) not a member of a NCAA-sanctioned team, and (d) at risk for exercise dependency (e) without high concern for eating disorder. Part B procedures were delimited to (f) six days of (g) up to 60 minutes of preferred or imposed physical activity, or no physical activity, and (h) completing the Exercise-induced Feeling Inventory.

**Limitations**

Limitations of this study included (a) participants having conflicting activities, events, and time commitments that impeded their ability to participate, (b) completing questionnaires and survey responses honestly, (c) a small sample size for the experimental portion of the study \( n = 5 \), (d) 4 out of 5 participants preferring aerobic physical activity and were then assigned a resistance training activity, (e) the honesty of participant’s efforts and intentions during exercise sessions and (f) the timing of feeling states in Part B of the study.

**Assumptions**

The following study assumed that participants were honest on all responses to questionnaires and surveys and participants were fully self-aware and were able to answer questions on personality inventories. This study also assumed that participants only took part in the assigned condition for that day, with no other strenuous physical
activity and did not engage in any physical activity on deprivation days for Part B of the study.

**Operational Definition of Terms**

1. Aerobic Physical Activity: Activity in which the body's large muscles move in a rhythmic manner for a sustained period of time. Aerobic activity, also called endurance activity, improves cardio respiratory fitness. Examples include walking, running, and swimming, and bicycling (United States Department of Health and Human Services [USDHHS], 2008).

2. Amotivation: This type of behavioral regulation covers non-intentional behavior. Essentially, there is no distinct reason for the person to engage in a specific behavior (Moreno, Cervelló, & Martínez, 2007).

3. At-Risk: According to the EDS-R a person is at-risk for exercise dependency if they respond with a 5 or 6 (showing a strong endorsement) on at least 3 out of the 7 subscales (Symons Downs, Hausenblas, & Nigg, 2004).

4. Athlete: Anyone who was a member of a National Collegiate Athletic Association-sanctioned team.

5. Exercise Dependency: Physical activity that is severe in occurrence and length, resilient to change, and is often linked to an uncontrollable desire to continue exercise in spite of injury, illness, fatigue, or other personal responsibilities (Hausenblas & Symons Downs, 2002).

6. Exercise Identity: The degree to which exercise is expressive of an individual’s self-concept (Anderson & Cychosz, 1994).
7. External Regulation: Behavioral regulation that is characterized by a person engaging in a behavior in order to receive an external reward or because of external factors (Moreno et al., 2007).

8. High Risk: According to the EAI a person is considered to be at a high risk for exercise dependency if they have a total score at or above 24 (Terry, Szabó, & Griffiths, 2004).

9. Introjected Regulation: Behavioral regulation that involves a person choosing to take part in a type of behavior so they do not feel guilty or anxious about not doing the behavior (Moreno et al., 2007).

10. Identified Regulation: Behavioral regulation in which a person chooses to do a behavior because they believe the behavior is valuable (Moreno et al., 2007).

11. Intrinsic Regulation: Behavioral regulation is chosen liberally, and the reward is the behavior itself, which is something enjoyable to that person (Moreno et al., 2007).

12. Resistance Training: Physical activity including exercise that increases skeletal muscle strength, power, endurance, and mass (USDHHS, 2008).
CHAPTER 2
REVIEW OF LITERATURE

The purpose of this study is to further elucidate the concept of exercise dependency by investigating personality traits, motivational factors, and feeling states among an exercise dependent sample. In order to do this, past literature must be examined and understood.

It is widely accepted that physical activity can provide ample positive benefits to one’s health and psychological well-being (Hausenblas & Symons Downs, 2002). However, there is also evidence that suggests physical activity in excess can lead to deteriorating physical and psychological states among both athletes and non-athletes (Adams & Kirkby, 2001). Although the notion that a person can be physically active to the point that it begins to show negative signs has been examined, professionals have yet to decide on a concise and consistent term and definition for this phenomenon. Currently, the most widely used term to describe this is exercise dependency (Berczik et al., 2012). The literature review will explore concerns regarding physical inactivity, the importance of physical activity, and possible adverse effects of physical activity. The review will also introduce exercise dependency, attempt to operationally define this phenomenon, examine past and current assessment tools of exercise dependency, and explore possible mechanisms for exercise dependency.

Prevalence of Physical Inactivity

According to Kohl and colleagues, approximately 31% of the people in the world currently do not achieve the minimum recommendations for physical activity (Kohl et al., 2012). The importance of this has been shown by Lee et al. (2012) who explained that
possibly six to ten percent of all deaths stemming from non-communicable diseases throughout the world could be related to physical inactivity.

Physical inactivity has been linked to and may be a leading cause of obesity (Lee et al., 2012). For example, Pietiläin et al. (2008) investigated the role of physical activity levels in youth with regards to obesity and abdominal obesity in adulthood via a longitudinal twin study. The results showed that physical inactivity was a strong independent predictor of abdominal obesity in young adults. According to data collected by the Center of Disease Control and Prevention (CDC), almost 36% of American adults and just below 17% of American youth were considered obese in 2009-2010. The CDC considers a person to be obese if their body mass index (BMI) is equal to or exceeds 30kg/m² (Ogden, Carroll, Kit, & Flegal, 2012).

**Importance of Physical Activity**

Physical activity has been shown to have numerous positive benefits for a person’s health including the prevention and or treatment of many diseases and medical conditions. According to the CDC (2011), physical activity can help control a person’s weight, decrease the risk of cardiovascular disease and type II diabetes, reduce the risk for some cancers, improve mood and mental health, increase bone and muscle strength, and jointly decrease the risk of falls in older adults and increase their ability to complete everyday tasks.

Scientific evidence has shown that physical activity may only have a slight effect on weight loss in the beginning of a weight loss program. However, it has been shown that exercise plays a crucial role in weight loss maintenance. In a study conducted by Jakicic, Marcus, Lang, and Janney (2008), those who were able to maintain a weight loss
of 10% of total body weight for 24 months were engaging in approximately four and a half hours of physical activity per week. Bassuk and Manson (2005) provided epidemiological evidence for physical activity decreasing the risk of type II diabetes. The authors explain that decreasing the risk of type II diabetes has also been linked to decreasing cardiovascular disease. A study by Matthews et al. (2001) of Chinese participants compared lifetime physical activity levels among recently diagnosed Chinese breast cancer patients with a similar number of age-matched controls. The researchers concluded that regular high intensity physical activity was inversely related to breast cancer risk in women. Kanning and Schlicht (2010) provided evidence for physical activity increasing mood states of individuals, showing that after activities such as walking or gardening participants reported higher levels of energetic arousal, calmness, and valence.

Evidence supporting physical activity increasing bone and muscle strength includes a cross-sectional study conducted in by Jónsson et al. (1992), which showed that active women over fifty years of age had significantly higher bone mass and muscular strength than those that were inactive. As a person ages there is a natural decline in muscle and bone mass, this could lead to possible falls and injuries. Engaging in physical activity can counteract the natural loss to a certain degree. In a study that involved low intensity resistance training of elderly participants, muscle mass and strength increased (Fiatarone et al., 1994). Increasing physical activity, especially with weight bearing activities has been shown to increase bone strength as well, which could lead to a decrease in falls and injuries (Smith & Gilligan, 1991).
Possible Adverse Effects of Physical Activity

Even though physical activity is recommended for most individuals and in most cases beneficial, there is a possibility of injury. It has been found that the risk of injury is linked to the type of activity, rate of occurrence, and intensity of activity along with a person’s physical characteristics and the environment in which the activity takes place (Koplan, Siscovick, & Goldbaum, 1985). Injuries involved with physical activity are usually musculoskeletal, which involves injuries to muscles, bones, tendons, joints and or ligaments. In a study looking at injuries during physical activity, injury occurrence rose when the participants were engaged in running, organized sports, took part in more than 1.25 hours of physical activity per week, and if they had higher cardiovascular fitness levels (Hootman et al., 2001). Overall, it is important to understand both the benefits and risks of physical activity and engage in appropriate levels and types of activity to try to avoid injury and receive the possible benefits that being active have to offer (Koplan et al., 1985).

As stated previously, physical activity can be beneficial in many ways, however, there are possible negative consequences as well when physical activity far exceeds the suggested recommended amount. Overtraining is a state where the physiological requirements of an exercise routine exceed the capacity for a person’s body to adapt to that demand. Overtraining can have detrimental effects on a person’s neuroendocrine, immune, cardiovascular, and musculoskeletal systems. Overtraining can also cause severe negative psychological effects (Adams & Kirkby, 2001). Overtraining is usually associated with an extended period of a deficit in performance due to inadequate recovery and excessive training. A study by Matos, Winsley, and Williams (2011) showed that
approximately one third of 376 English youth athletes that were polled experienced signs of overtraining; many of these athletes were involved in individual sports. It is important to understand the needs of athletes to properly recover from and adapt to the stresses placed on their bodies in order for them to perform at their best.

Overall, research has focused heavily on physical activity and what may occur if people do not get the recommended amounts. However, there has been little effort to explore the other end of the spectrum, where people are excessively engaging in physical activity. In order to fully understand the possible benefits and what should be the recommended amount of physical activity, efforts should be made to understand both sides of the spectrum equally (Adams et al., 2012).

**Overview of Exercise Dependency**

Physical activity can be beneficial but when it begins to enter the other end of the spectrum in excessive amounts; it can have severe negative consequences in regards to a person’s physical and psychological well-being (Berczik et al., 2012). Examples of these negative consequences include overuse injuries, increasing tolerance so more time must be dedicated to the activity to get the desired response, and increases in negative affect when a person is not able to take part in physical activity (Kerr, Lindner, & Blaydon, 2007).

**Characterizing Exercise Dependency.** Professionals have found it difficult to agree upon a consistent and finite term and/or definition for excessive physical activity primarily because of its multidimensional nature. For example, this concept involves psychological aspects, mood and motivation, medical concerns including overuse injuries; and is clearly related to exercise science in some respects. Therefore, these
different fields may have dissimilar preferences for terms, which have contributed to the confusion (Berczik et al., 2012). Terms that have been used include exercise dependency (Cockerill & Riddington, 1996; Hausenblas et al., 2002), exercise addiction (Griffiths, 1997; Szabó, 2010; Thaxton, 1982; Berczik et al., 2012), obligatory exercise (Pasman & Thompson, 1988), exercise abuse (Davis, 2000), and compulsive exercise (Dalle Grave, Calugi, & Machesini, 2008). For the purpose of this literature review, exercise dependency will be the primary term used throughout.

According to Berczik et al. (2012), exercise dependency is the most commonly used term and most accepted among professionals. In general, exercise dependency can be defined as physical activity that is severe in occurrence and length, resilient to change, and is often linked to an uncontrollable desire to continue exercise in spite of injury, illness, fatigue, or other personal responsibilities (Hausenblas & Symons Downs, 2002). Hausenblas and Symons Downs (2002) have also used the Diagnostic and Statistical Manual-IV for substance abuse from the American Psychological Association (APA), to suggest a more specific outline of exercise dependency. The researchers suggested applying seven important aspects of which three needs to be present for a person to be considered exercise dependent. Two of the seven were mentioned previously 1) tolerance, increasing the amount of a specific behavior to create the same response and 2) withdrawal, the negative effects that occur when behavior is ceased. Also included are: 3) intention, a person engages in physical activity longer than originally intended; 4) loss of control, a person cannot decrease exercise whether they want to or not; 5) time, more time is spent trying to exercise whenever possible; 6) conflict, a person gives up social, recreational, and or work related activities to focus more on exercise; and 7) continuance,
a person continues to exercise even with the understanding that they have a physical or psychological issue that is caused or exaggerated by exercise (Hausenblas & Symons Downs, 2002).

**History of Exercise Dependency.** The phenomenon of exercise dependency was first introduced in 1970 by Baekeland. This landmark study investigated the effects of the cessation of exercise on sleeping patterns over one month. Initially, individuals who were active five to six days per week were asked to participate, but declined in spite of being offered incentives. This suggested a strong commitment to their exercise routines and possible dependency on exercise. A modification to the study was made to recruit those who were physically active three to four days per week. These results suggested that ceasing physical activity markedly impacted daily functioning of the participants. These negative consequences included increased anxiety levels, the need to be around others, and sexual tensions. Cessation of exercise also resulted in a decrease of appetite and sleep quality (Baekeland, 1970).

Following the original introduction to the concept of exercise dependency, much of the research has focused on the addiction aspect of the topic and attempting to discern whether it should be considered an addiction at all (Hausenblas & Symons Downs, 2002). This led to attempts to determine if exercise dependency should be considered a positive (Glasser, 1976) versus a negative addiction (Morgan, 1979). A positive addiction involves a positive dose-response, meaning the addiction has some type of positive effect when the activity or behavior is completed. It has been argued that exercise dependency could be considered a positive addiction because of the possible benefits and the positive dose-response in regards to physical activity and health (Glasser, 1976). However, some
believe that it should be considered a negative addiction because of the possible adverse effects that excessive exercise could cause, which include injuries and the possible abandonment of everyday tasks (Morgan, 1979 and Griffiths, 1997). Griffiths (1997) argued that Glasser’s (1976) proposal of positive addiction was incorrect because what Glasser (1976) explained as symptoms were very different from already accepted symptoms of addiction (Berczik et al., 2012).

Researchers have attempted to determine whether exercise dependency should be considered either a primary or a secondary dependency. A primary dependency manifests by itself, whereas a secondary dependency usually occurs alongside a primary dependency and is brought upon to enhance a desired effect. A large portion of research in regards to exercise dependency has involved trying to establish it as a primary dependency (Berczik et al., 2012).

In early 1980s, researchers began to attempt to determine whether exercise dependency and anorexia nervosa were related. Researchers believed that eating disorders were considered the primary dependency whereas exercise dependency was a secondary dependency. Results of the first study addressing this topic showed similarities between male “obligatory runners” and women who have anorexia nervosa in their family background, socioeconomic status, and certain personality characteristics (Yates, Leehey, & Shisslak, 1983). Since that initial study, there have been many attempts to establish a relationship and gain further understanding. For example, in one study, 16 female exercisers were interviewed using the Eating Disorders Examination (EDE; Cooper & Fairburn, 1987) and the Exercise Dependence Interview (EXDI), created by the researchers specifically for the purpose of their study (Bamber, Cockerill, Rodgers, &
Carroll, 2000). The results showed that exercise dependency always occurred alongside an eating disorder, prompting the researchers to establish exercise dependency as a secondary dependency (Bamber et al., 2000). Several other corroborators have shown that excessive exercising and disordered eating occur together often (Brewerton, Stellefson, Hibbs, Hodges, & Cochrane, 1995; Chalmers, Catalan, Day, & Fairburn, 1985; Downes, 1998; Ryan, 1997; Touyz, Beumont, & Hook, 1987; Veale, 1985, 1987).

While there has been evidence for exercise dependency occurring as a secondary dependency, there have also been studies conducted that show support for the possibility for exercise dependency occurring on its own. Blaydon and Lindner (2002) had 203 triathletes complete the Exercise Dependence Questionnaire (EDQ) and the Eating Attitudes Test (EAT-26). Four separate groups emerged after analyses, including a single group that scored high on the EDQ solely, leaving the researchers to believe that exercise dependency may be a primary dependency (Blaydon & Lindner, 2002). Considering the variation of results among the studies, the relationship between eating disorders and exercise dependency is not fully understood. Bamber, Cockerill, Rodgers and Carroll (2000) argue that this may be due to major limitations in previous studies of exercise dependency, including the exclusion of eating disorder screening altogether.

Much of the exercise dependency research has been concerned with addressing the consequences of depriving a person who is considered exercise dependent from his or her regular routine of physical activity (Baekeland, 1970; Hausenblas, Gauvin, Symons Downs, & Duley, 2008; Lepage, Price, O’Neil, & Crowther, 2012; and Aidman & Woollard, 2001). The research has attempted to provide possible symptoms and explanations for this phenomenon (Szabó, 1995). Past deprivation research has been
based on the fact that physical activity can have positive effects on mood states and, therefore, if exercise is ceased, could cause negative effects. These include increasing anxiety, fatigue, and/or anger. These positive and negative fluctuations could occur in both dependent and non-dependent people; however, they should be amplified in the exercise dependent groups (Szabó, 1995). Hausenblas, Gauvin, Symons Downs, and Duley (2008) argued that the varying results of the effects of exercise deprivation among exercise dependent participants could be explained by unsound methodology.

Hausenblas et al. (2008) examined the effects of deprivation of regular exercise on feeling states. Using the Exercise-induced Feeling Inventory (EFI), feeling states were reported each day. Three days were spent engaging in physical activity, three days were not. The researchers found that there were definite increases in positive mood states following exercise. They also found that those who were deprived of exercise but not considered exercise dependent had higher positive feeling states on deprivation days than non-exercise days. They proposed this was because they were instructed not to exercise and therefore, they did not perceive this to be their fault. However, they found that those who were considered to be exercise dependent had the same feeling states on deprivation and non-exercise days (Hausenblas et al., 2008).

In a similar study, Lepage, Price, O’Neil and Crowther (2012) used an ecological momentary assessment for 51 female participants who exercised at least three times a week and did not have an eating disorder. The researchers attempted to examine their natural exercise patterns and positive and negative affect levels over a ten-day period. They found that an absence of exercise had less of an effect than the obligation to
exercise. In other words, the more a person felt obligated to exercise, the lower the positive affect would be on deprivation days.

Aidman and Woollard (2001) investigated acute emotional and physiological responses to a short notice, 24-hour period of deprivation of exercise among self-reported exercise dependent participants. The researchers found that those who considered themselves to be dependent to exercise showed significantly higher levels of depression, tension, anger, fatigue, and confusion, while also experiencing reduced vigor. They also found that the dependent group showed significantly higher resting heart rates within the 24-hours following a missed exercise session.

**Assessing Exercise Dependency.** Exercise dependency is not currently officially recognized within any medical or psychological diagnostic guidelines; however, there are known and similar symptoms to associated dysfunctions, which show the importance of the issue to be addressed and examined for further understanding (Berczik et al., 2012). Early assessments have been criticized because they were measuring exercise dependence indirectly and focusing on withdrawal symptoms. Later assessments that attempted to measure exercise dependence directly were criticized for being limited (only focusing on one sport or activity), not creating operational definitions for exercise dependence, and not providing scoring procedures (Kerr, Lindner, & Blaydon, 2007). Since this is a relatively new issue and much of the research conducted has shown varying results, it is difficult to come up with set rules at this time to diagnose and assess exercise dependency. However, attempts have been made to come up with measures to aid in assessment and further research (Adams, Miller, & Kraus, 2003).
To highlight some of the commonalities and disparities in the psychological instruments used in exercise dependency research, a chronological list is presented in Appendix A. Most of the instruments available account for psychological or emotional facets of exercise dependency. This is accomplished through the use of Likert-type response formats which allow the investigator to assess the frequency (Obligatory Exercise Questionnaire, OEQ; Yates, Edman, Crago, & Crowell, 2001) or strength of agreement (Exercise Dependence Questionnaire – Revised, EDS-R; Symons Downs, Hausenblas, & Nigg, 2004). Only the Exercise Dependence Interview (EDXI; Bamber, Cockerill, Rodgers & Carroll, 2000) and the Exercise Beliefs Questionnaire (EBQ; Loumidis & Wells, 1998) allow for open-ended responses via an interview format.

Despite the theoretical association with eating disorder behavior, few of the instruments include subscales for eating disorders or physical appearance. Only the EDQ (Ogden, Veale, & Summers, 1997), EBQ (Loumidis & Wells, 1998), and BDS (Smith, Hale, & Collins, 1998) factor in the proposed relationship between exercise dependency and eating disorders. In comparison, more instruments include a social dimension (exercise for social reasons [EDQ]; social desirability [EBQ]; social dependence [BDS]; negative impact on social/occupational aspects of life [EDXI]; reduction in other activities [EDS-R]).

It appears that in the development of psychological instruments of exercise dependency certain primary factors theorized to be part of the behavior did not develop together. For example, tolerance and withdrawal have both been closely linked in the understanding of exercise dependent behavior. Yet, in the 15 year period spanning the
most common exercise dependent measures, *withdrawal* was only first introduced in 1997 (EDQ) and *tolerance* did not receive attention until 2004 (EDS-R).

A shift occurred in the late 1990s whereby the term and the related dimensions of exercise dependence began to more closely align to the psychological instruments. The development of the EDQ (Ogden, Veale, & Summers, 1997) was the first time exercise dependence was used in the title. Previous attempts used descriptors such as “obligatory” and “commitment” or were activity-specific (Bodybuilding Dependency Scale; Smith, Hale, & Collins, 1998). Moreover, it was during this period that the term continued to be refined and more closely associated with substance abuse. As such, many of the instruments began to incorporate the notion of withdrawal symptoms and disturbances in social, family, and occupational settings (Hausenblas & Symons Downs, 2002).

Due to the confusion surrounding exercise dependency, including the terminology and definition it has been difficult for researchers to determine a single approach to measuring the phenomenon. Assessments for exercise dependency have evolved as research has revealed more about the complex disorder. While it is apparent that many assessments have been created and may be valid and reliable, it appears they could be measuring different aspects of exercise dependency (Adams et al., 2012).

**Etiology Summary.** Research has attempted to determine possible reasons that may lead to a person becoming exercise dependent (Berczik et al., 2012). As the previous section on the assessments that are available for exercise dependency suggests, the context is multidimensional in nature. These assessments have tried to measure certain aspects and factors that could explain this phenomenon. These include social factors, such as the BDS investigating social dependence; physiological aspects, for instance the
possibility of a person building tolerance to exercise that is addressed in the EAI; psychological issues, for example addressing emotional functioning in the EBQ, and lastly environmental aspects like participating in certain sports (Pierce, Eastman, Tripathi, Olson, & Dewey, 1993). This section is intended to highlight some of the mechanisms frequently thought to contribute to exercise dependency.

An overview of the various proposed mechanisms of exercise dependency is provided in Appendix B. Despite the different underlying paths for each mechanism, most are theorized to be related to the “feel good” phenomena commonly associated with exercise. That is, as an individual exercises, he or she is likely to experience positive feelings or improved mood. This improvement is then thought to contribute to greater levels of exercise behavior (e.g., intensity, duration, frequency) and thereby contribute to the onset of exercise dependency. It is also apparent in Appendix B that many of the proposed mechanisms have yet to be tested (e.g., cytokine hypothesis; Hayley, Merali, & Anisman, 2003; Hamer & Karageorghis, 2007), are inconclusive (thermogenic hypothesis; Berczik et al., 2012; Cooke, 1983; De Vries, 1981), or are only partially supported by evidence (e.g., motivational factors; Duncan, Hall, Jenny, & Wilson, 2010; Hamer, Karageorghis, & Vlachopoulos, 2002; Ryan & Deci 2000).

Of the proposed mechanisms that do show some degree of support, these rely heavily on intrapersonal factors. In particular, motivational factors (Duncan, Hall, Jenny, & Wilson, 2010; Hamer, Karageorghis, & Vlachopoulos, 2002; Ryan & Deci 2000), personality attributes (Hall, Hill, Appleton, & Kozub, 2007; Hagan & Hausenblas, 2003), and involvement in sports (Hurst, Hale, Smith, & Collins, 2000; Estok & Rudy, 1986; Hale, Roth, Delong, & Briggs, 2010; Pierce & Daleng, 1998; Pierce, McGowan, & Lynn,
1993; Smith, Wright, & Winrow, 2010) all seems to provide a link to possible exercise dependent behavior. This remains an open area of investigation for researchers interested in better understanding exercise dependency.

Another theoretical association between the proposed mechanisms and exercise dependency that seems incongruent relates to its tie with eating disorders. Few of the proposed mechanisms take into consideration eating disorders relative to the development of exercise dependency. Specifically, only the anorexia analogue hypothesis (Bamber et al., 2000; Coen & Ogles, 1993; Hamer & Karageorghis, 2007; Yates et al., 1983) and environmental factor of gender (Pierce, Rohaly, & Fritchley, 1997; Weik & Hale, 2009) link exercise dependency and eating disorders. While this may reflect some of the confusion surrounding exercise dependency as either a primary or secondary issue to maladaptive eating behaviors, it also suggests the need to better conceptualize exercise dependency.

**Summary.** At one extreme on the physical activity spectrum exists exercise dependency. Exercise dependency is a relatively new phenomenon and while research exists on the topic, it is sparse and inconclusive (Hausenblas & Symons Downs, 2002). It is apparent that exercise dependency is of concern in medical, psychological, and exercise science related fields. Considering exercise dependency crosses over several disciplines there are many different approaches and perspectives being applied to this phenomenon. Therefore, ample confusion continues to surround exercise dependency (Berczik et al., 2012). This confusion has made it difficult for professionals to agree on a single term and definition, which has led to numerous assessments and diagnostic criteria for exercise dependency (Adams et al., 2012). Since exercise dependency is still in its
infancy, little is known about the etiology of exercise dependency but researchers have proposed that there are social, psychological, physiological, and environmental factors that may play a part in a person becoming exercise dependent. Overall, the research that has explored the concept of exercise dependency seems to illuminate the idea that exercise dependency is multidimensional and complex in nature. Considering so little is known about exercise dependency, it is clear that further research is needed (Berczik et al., 2012).
CHAPTER 3

METHODS AND PROCEDURES

This study examined individual dispositional measures for their association with self-reported excessive exercise to further elucidate the concept of exercise dependency. Moreover, the influences of engaging in preferred versus assigned forms of exercise and abstaining from exercise on emotional responses in a sample of college-aged participants self-reporting excessive exercise patterns were investigated. Specifically, in accordance with the existing literature, emotional responses are thought to be positively influenced when engaging in exercise. This study sought to determine if the same responses would occur during an assigned activity that is different from the participant’s preferred modality of exercise.

Method

Participants. Approval to conduct the study and informed consent paperwork (Part A; Appendix D and Part B; Appendix E) were applied for and approved through the SUNY-Cortland Institutional Review Board for the protection of human subjects (Appendix C). For the first portion of this study, 423 participants (230 men, 193 women) were recruited from SUNY-Cortland undergraduate and graduate classes. Participants were between the ages of 17 and 31 years old ($M = 20.90, SD = 1.75$).

For the second portion of this study, 5 participants were recruited (2 men, 3 women) based on their scores on the EDS-R, the EAI, and the EAT-26. Participants were apparently healthy, physically active, non-active National Collegiate Athletic Association athletes and non-smokers. Participants had no known medical contraindications to
participating in physical activity as measured by the Physical Activity Readiness Questionnaire (PAR-Q, Appendix F).

**Instrumentation.**

**Demographic profile (Appendix G).** This document was used to obtain basic demographic information including: participant’s name, age, gender, and frequency and intensity of regular physical activity.

**Measures for Part A (Appendix G).**

**Exercise Dependence Scale Revised (EDS-R).** The EDS-R (Symons Downs, Hausenblas, & Nigg, 2004) was advanced from the original EDS (Hausenblas & Symons Downs, 2002). The EDS-R is self-completed and contains 21 items using a 6-point Likert scale using the frequency responses of “Never” and “Always.” This scale was used to distinguish between those who are at-risk (score of 5 – 6 for 3 of the 7 subscales), nondependent-symptomatic (score of 3 – 4 on the subscales) and nondependent-asymptomatic (score of 1 – 2 on the subscale) using the following factors based on DSM-IV criteria; (a) tolerance, (b) withdrawal effects, (c) intention effect, (d) lack of control, (e) time, (f) reductions in other activities, and (g) continuance. Symons Downs et al. (2004) reported adequate internal consistency (Cronbach’s α range = .78 to .92) and test-retest reliability ($r = 0.95$).

**Exercise Addiction Inventory (EAI).** The EAI (Terry, Szabó, & Griffiths, 2004) is a six item questionnaire with a 5-point Likert scale with response options ranging from 1 (“Never”) to 5 (“Always”). The EAI is based on six aspects of behavioral addiction including (a) salience (i.e., making a certain activity the most important in a person’s life and preoccupies their thoughts), (b) mood modification (i.e., a change in one’s
perceptions of effects resulting from a specific activity), (c) tolerance (i.e., when a person has to increase the amounts of an activity to receive the same response), (d) withdrawal (i.e., experiencing undesirable mood or physical states when activity is stopped), (e) conflict (i.e., experiencing both intra-individual and inter-individual disagreements, or between other activities, that is directly related to the specific activity), and (f) relapse (i.e., revert back to old patterns of activity after abstinence from that activity).

The EAI was used to group participants within the following categories for exercise addiction: high risk (a total score of ≥ 24), symptomatic (a score between 13 and 23), and asymptomatic (a score of ≤ 12). Terry, Szabó, and Griffiths (2004) and Griffiths, Szabó, and Terry (2005) reported adequate internal consistency (Cronbach’s α = 0.84), concurrent validity with other established measures (r = 0.80 and 0.81), split-half correlation (r = 0.84) and test-retest reliability (r = 0.85).

**Eating Attitudes Test-26 (EAT-26).** The EAT-26 was developed from the Eating Attitudes Test-40 (EAT-40; Garner & Garfinkel, 1979) and is a 26-item self-report measure that assesses the degree of anorexia nervosa and bulimia nervosa symptoms. The instrument uses a 7-point Likert scale and response frequencies ranging from 1 (“Never”) to 7 (“Always”). The EAT-26 measures psychological, attitudinal and behavioral traits that are often seen in people with eating disorders from three subscales, including (a) dieting, (b) bulimia and food preoccupation, and (c) oral control. A score of 20 or higher on this test suggested the respondent may have concerns regarding body weight, shape, and eating and should seek advice from a qualified mental health professional. The EAT-26 has shown good reliability (Cronbach’s α = .90 for the anorexia nervosa group) and
validity (correlated with Factor 1, $r = 0.90$; Factor 2, $r = 0.64$; Factor 3, $r = 0.60$) (Garner, Olmstead, Bohr, & Garfinkel, 1982).

**Exercise Identity Scale (EIS).** The EIS (Anderson & Cychosz, 1994) measures the degree to which exercise is expressive of an individual’s self-concept. The one-dimensional measure includes nine items scored using a 5-point Likert scale ranging from 1 (“Strongly disagree”) to 5 (“Strongly agree”). The EIS provided a total score with a higher score suggesting that the individual perceived exercise to be a greater part of his or her overall self-concept. Anderson and Cychosz (1994) reported adequate internal consistency (Cronbach’s $\alpha = 0.94$) and test-retest reliability ($r = .93$).

**Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2).** The BREQ-2 (Markland & Tobin, 2004) was used to measure different types of exercise behavioral regulations based on the self-determination theory. This questionnaire was revised from the original version by Mullan, Markland, and Ingledew (1997) and includes the additional behavioral regulation of amotivation. The BREQ-2 includes 19 items using a 5-point Likert scale with the anchors of 0 (“Not true for me”) and 4 (“Very true for me”). The BREQ-2 provides a total score as well as scores for the subscales of (a) amotivation, (b) external regulation, (c) introjected regulation, (d) identified regulation, and (e) intrinsic regulation. A higher score on any of the respective subscales suggested that type of behavioral regulation governed the participant’s exercise behavior. Markland and Tobin (2004) reported acceptable internal consistency values (Cronbach’s $\alpha$ ranging from -0.79 to 0.86).

**Preference for and Tolerance of the Intensity of Exercise Questionnaire (PRETIE-Q).** The PRETIE-Q (Ekkekakis, Hall, & Petruzzello, 2005) includes 16 items
with a two factor measure (preference for and tolerance of high intensity vs. low intensity) that can aid in the comprehension of individual differences in response to exercise. A 5-point Likert scale is used for each item and response options range from 1 (“I totally disagree”) to 5 (“I totally agree”). This measure was used to determine a participant’s predisposition towards a preference for low or high and tolerance of high exercise intensities levels. Ekkekakis, Thome, Petruzello, and Hall (2008) reported acceptable internal consistency values for the Preference and Tolerance subscales (Cronbach’s α of 0.89 to 0.86, respectively) and Ekkekakis et al. (2005) reported adequate 3- and 4-month test-retest reliability scores for the Preference (range from $r = 0.67$ to 0.80) and Tolerance (range from $r = 0.85$ to 0.72) subscales.

**Measures for Part B (Appendix H).**

**Exercise Feeling Inventory (EFI).** The EFI (Gauvin & Rejeski, 1993) is a 12-item measure of feeling states derived from exercise participation and includes four subscales: (a) positive engagement, (b) revitalization, (c) physical exhaustion, and (d) tranquility. Participants responded to each item on a 5-point Likert scale ranging from 0 (“Do not feel”) to 4 (“Feel strongly”). This measurement allowed for measurements of feeling states across the conditions and times. Gauvin and Rejeski (1993) reported acceptable internal consistency values for the each of the four subscales (Cronbach’s α ranges: Positive Engagement – 0.74 to 0.82; Revitalization – 0.78 to 0.87; Physical Exhaustion – 0.80 to 0.91; Tranquility – 0.72 to 0.82) as well as concurrent, discriminant, and construct validity.

**Procedure and Research Design.** After Institutional Review Board approval (Appendix C), participants were recruited from SUNY-Cortland via responses to an
Internet delivered series of surveys and questionnaires using SurveyGizmo.com. The option to participate in the survey and questionnaire portion of the research was made available to all SUNY-Cortland students. In order to respond to the series of surveys and questionnaires, potential participants were prompted to fill out and electronically affirm an informed consent, showing their understanding of the experiment and ability to participate. Upon completion of this series of surveys and questionnaires, participants were selected to continue on to the experimental portion of the research if their score on the EDS-R qualified them based on a cutoff score of either 5 or 6 for 3 out of the 7 subscales or if they met the criteria of the EAI based on a total cutoff score of 24. Participants also had to score below a total cutoff score of 20 on the EAT-26 to be selected. Participants that met these criteria were able to take part in an experimental part of the study of six sessions of physical activity.

The series of surveys and questionnaires were administered from the SUNY-Cortland’s Internet server using SurveyGizmo.com to all SUNY-Cortland students. Once all survey and questionnaire responses had been collected, scores were tabulated. Those who met the minimum score and above for high risk within the EDS-R and EAI were then separated out. The researcher examined those participant’s scores that categorized them as high risk for exercise dependency (n = 54). If they also fell into the high risk category for an eating disorder, as assessed by the EAT-26 (a total cutoff score of 20), they were excluded from this study. At this point, participants who did not meet the requirement for a high risk of exercise dependency, were high risk for an eating disorder, were a smoker, and/or reported being an NCAA sanctioned athlete did not proceed any further with the study (n = 28).
Once all participants that had a high risk for exercise dependency without a high risk for an eating disorder and no NCAA participation in a sport had been determined \((n = 26)\), they were contacted to ask if they would participate in Part B of the study. Once participants agreed to take part in the study \((n = 5)\), they were placed into groups based on their preferred modality of physical activity. This consisted of two generalized groups, resistance training or aerobic training. A participant was considered to prefer resistance training if 80% or greater of his or her total training time was spent on resistance training-type physical activity. Conversely, a participant was considered to prefer aerobic training if 80% or greater of his or her total training time included aerobic-type physical activity. At this point, identified participants were randomly assigned to a sequence of training activities that they were asked to adhere to each day. The six sessions included a total of two days of the participant’s preferred modality of physical activity (resistance training or aerobic), two days of an imposed (i.e., opposite) modality of physical activity (e.g., if the preferred mode was aerobic-type physical activity, the participant engaged in resistance training-type physical activity), and two days of no physical activity (i.e., exercise deprivation). Table 1 provides an example of a possible six session sequence that a participant may have completed.

Table 1

*An Example of a Randomized Six-Session Sequence of Physical Activity*

<table>
<thead>
<tr>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance PA</td>
<td>Deprivation</td>
<td>Resistance PA</td>
<td>Aerobic PA</td>
<td>Deprivation</td>
<td>Aerobic PA</td>
</tr>
</tbody>
</table>
The aerobic activity for those who preferred resistance training consisted of a 60-minute stationary cycling program at a self-selected intensity. The resistance training activity for those who preferred aerobic training consisted of a beginner full body resistance training program that took approximately 45 minutes to complete. The participants self-selected the resistance used for each exercise. With the assistance of a certified fitness trainer there was an instructional meeting set up prior to the start of the approximate one week experiment to ensure the compliance and safety of all participants. This meeting included explanations of all exercises and demonstrations. A written workout plan was also provided at this time so participants were able to record and remember their assigned activities (Appendix I).

It should be noted that participants only completed physical activity when they normally would have engaged in their preferred activity. If participants only trained on Monday, Wednesday, and Friday, they were only asked to train on those days.

Throughout the approximate one week period, participants were asked to respond to the EFI (Appendix H). A packet with a sufficient number of the inventories was provided to each participant. The participants were asked to complete this inventory at four designated times each day. The designated times corresponded to the following on exercise days: (a) within 30 minutes of waking up, (b) no more than five minutes pre-exercise, (c) no more than five minutes post-exercise, and (d) no more than 30 minutes before bed. On days when the participants were not allowed to engage in any exercise, they were asked to fill out the survey (a) within 30 minutes of waking up, (b) approximately four hours following that time, (c) four hours after the second survey
completion, and (d) no more than 30 minutes before bed. Table 2 provides an example of designated times for completion of the EFI.

Table 2

*Example of Designated Times for Completion of the Exercise-induced Feeling Inventory (EFI)*

<table>
<thead>
<tr>
<th>Session 1</th>
<th>Session 2</th>
<th>Session 3</th>
<th>Session 4</th>
<th>Session 5</th>
<th>Session 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred physical activity (Lift)</td>
<td>Exercise deprivation</td>
<td>Preferred physical activity (Lift)</td>
<td>Assigned physical activity (Aerobic)</td>
<td>Exercise deprivation</td>
<td>Assigned physical activity (Aerobic)</td>
</tr>
<tr>
<td>Pre-exercise: EFI</td>
<td>4 hours after wake up: EFI</td>
<td>Pre-exercise: EFI</td>
<td>Pre-exercise: EFI</td>
<td>4 hours after wake up: EFI</td>
<td>Pre-exercise: EFI</td>
</tr>
<tr>
<td>Post-exercise: EFI</td>
<td>4 hours after 2nd EFI</td>
<td>Post-exercise: EFI</td>
<td>Post-exercise: EFI</td>
<td>4 hours after 2nd EFI</td>
<td>Post-exercise: EFI</td>
</tr>
</tbody>
</table>

Each participant was also asked to record information following the imposed type of exercise. For those assigned resistance training, they were asked to report the amount of weight or resistance used for all exercises performed and their rate of perceived exertion (RPE) of the workout as a whole. For those assigned aerobic training, the participants were asked to record as much information as possible based on the stationary
bicycle used including (a) time, (b) distance, (c) levels of resistance, (d) heart rate, (e) speed, (f) revolutions per minute, and (g) watts, and their perceived exertion (RPE) of the workout as a whole.

**Statistical Analyses**

Descriptive statistics for all variables were calculated using the statistical software SPSS (version 19) and presented as mean ± SD. In order to examine the association between the EDS-R and the EAI, a chi-square test was performed. This examined both the categories provided by the EDS-R of “at-risk,” “nondependent-symptomatic,” and “nondependent-asymptomatic” and the EAI categories of high risk, symptomatic, or asymptomatic for exercise dependency.

Two multinomial logistic regressions were used to try to predict group classification from the EDS-R and EAI on information collected via the EIS, BREQ-2, and PRETIE-Q. For the first multinomial logistic regression, the categories derived from the EDS-R (“at-risk,” “nondependent-symptomatic,” and “nondependent-asymptomatic”) were the dependent variables. For the second multinomial logistic regression, the EAI (high risk, symptomatic, and asymptomatic) served as the dependent variables. The independent variables for both included; a total score on the EIS, total scores in each category of the BREQ-2 (amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation), and a total score for preference of intensity of a workout and tolerance of an intensity of a workout provided by the PRETIE-Q.

A chi-square test was also run in order to further examine the association between categories of the EDS-R (“at-risk,” “nondependent-symptomatic,” and “nondependent-asymptomatic”) and the EAI (high risk, symptomatic, or asymptomatic) and the highest
scoring category on the BREQ-2 (amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation).

Changes in the subscales of the EFI were analyzed with separate 3 x 4 repeated-measures analysis of variances (ANOVAs) for each subscale of the EFI (positive engagement, revitalization, tranquility, and physical exhaustion) with physical activity modality as an experimental condition (3 levels; regular physical activity; assigned physical activity; no activity) and time (4 time points; wake up; pre-exercise; post-exercise; bedtime). The significance level used for this portion was $p < 0.1$. 
CHAPTER 4
RESULTS AND DISCUSSION

The purpose of the study was two-fold. The first purpose was to investigate personality traits and motivation among an exercise dependent sample by using and examining theoretically based assessment tools. Secondly, this study aimed to measure feeling states under different types of physical activity among those who were considered to be exercise dependent.

Results – Part A

Demographics. This study consisted of two parts, the first part being a series of surveys administered to 423 SUNY-Cortland students. Table 3 provides general demographics along with descriptive statistics from the first part of the study. The participants consisted of a college aged population ($M = 20.90, SD = 1.75$) who were moderately active ($M = 4.60, SD = 1.58$) at a moderate intensity level ($M = 6.52, SD = 1.87$). Of the total number of participants 54.37% were males and 45.63% were females.
**Table 3**

Demographic Characteristics of Participants and Descriptive Statistics from Part A of Study

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>423</td>
<td>18</td>
<td>31</td>
<td>20.90</td>
<td>1.75</td>
</tr>
<tr>
<td>#Days of Exercise</td>
<td>423</td>
<td>0</td>
<td>7</td>
<td>4.60</td>
<td>1.58</td>
</tr>
<tr>
<td>*Intensity of Exercise</td>
<td>423</td>
<td>0</td>
<td>10</td>
<td>6.52</td>
<td>1.87</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Percent</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>230</td>
<td>54.37</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Female</td>
<td>193</td>
<td>45.63</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NCAA Athlete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>356</td>
<td>84.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>67</td>
<td>15.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Smoker</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>405</td>
<td>95.7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>4.3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>EAT-26</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High concern</td>
<td>42</td>
<td>9.90</td>
<td>27.57</td>
<td>8.37</td>
</tr>
<tr>
<td>Low concern</td>
<td>381</td>
<td>90.10</td>
<td>6.20</td>
<td>4.47</td>
</tr>
</tbody>
</table>

* Intensity of exercise was reported on a scale from 0-10.
**EAT-26 (The Eating Attitudes Test) is an assessment to determine those that are at risk for an eating disorder.

*EDS-R and the EAI.* The results from the EDS-R and the EAI appear in Table 4. Most participants were categorized as symptomatic on both scales (n = 270). The focus of the next discussion will mainly be on the at risk categories for exercise dependency. In order to examine the association between the EDS-R and the EAI, a chi-square test was performed. The frequencies for the categories given by the EDS-R, “at-risk,” “nondependent-symptomatic,” and “nondependent-asymptomatic” were examined with the EAI categories of high risk, symptomatic, or asymptomatic for exercise dependency. A significant association was found between the categories of the EDS-R and the categories of the EAI, $\chi^2 (4, n = 423) = 102.43, p < .05$. The results show that 71% of the
participants who were categorized as at risk for exercise dependency according to the
EAI were not categorized as at risk on the EDS-R and 59% of participants who were
categorized as at risk for exercise dependency on the EDS-R were not categorized as at
risk on the EAI.

Table 4

*EDS-R Categories *EAI Categories

<table>
<thead>
<tr>
<th></th>
<th>High Risk</th>
<th>Symptomatic</th>
<th>Asymptomatic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>At-Risk</td>
<td>11</td>
<td>15</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>N.-D. Symp</td>
<td>26</td>
<td>270</td>
<td>27</td>
<td>323</td>
</tr>
<tr>
<td>N.-D. Asympt</td>
<td>1</td>
<td>39</td>
<td>33</td>
<td>73</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>324</td>
<td>61</td>
<td>423</td>
</tr>
</tbody>
</table>

* EAI (Exercise Addiction Inventory) and EDS-R (Exercise Dependence Scale Revised) are assessments to
determine those that are at risk for exercise dependency.

**Personality traits and exercise dependency.** To explore the association between
the BREQ-2 and the EDS-R, a chi-square test was performed. The results from the
BREQ-2 and the EDS-R appear in Table 5. This test examined the frequencies of both the
categories given by the BREQ-2; amotivation, external regulation, introjected regulation,
identified regulation, and intrinsic regulation and by the EDS-R categories of “at-risk,”
“nondependent-symptomatic,” and “nondependent-asymptomatic” for exercise
dependency. A significant association was found between the categories of the BREQ-2
and the categories of the EDS-R, \( \chi^2 (8, n = 300) = 26.14, p < .05 \).
Table 5

*Frequency Results of Chi Square of Maximum BREQ-2 Category and EDS-R*

<table>
<thead>
<tr>
<th><em>EDS-R Categories</em></th>
<th><strong>EDS-R Categories</strong></th>
<th><strong>Maximum BREQ-2 Categories</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amot.</td>
<td>External</td>
<td>Introjected</td>
</tr>
<tr>
<td>At-Risk</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N.-D. Symp.</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>N.-D. Asymp.</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

*EDS-R (Exercise Dependence Scale Revised) is an assessment used to determine those that are at risk for exercise dependency.

**BREQ-2 (Behavioral Regulation in Exercise Questionnaire-2) is an assessment used to determine forms of regulation of exercise behavior. The maximum category determined was the category in which the participant scored the highest. Those who scored equally high in 2 or more categories were excluded from the analysis.

To investigate the association between the BREQ-2 and the EAI, another chi-square test was performed. The results from the BREQ-2 and the EAI appear in Table 6.

The categories given by the BREQ-2, amotivation, external regulation, introjected regulation, identified regulation, and intrinsic regulation and the categories provided via the EAI, high risk, symptomatic, and asymptomatic were examined. A significant association was found between the categories of the BREQ-2 and the categories of the EAI, $\chi^2 (8, n = 300) = 33.61, p < .05$. 
Table 6

*Frequency Results of Chi Square of Maximum BREQ-2 Category and EAI*

<table>
<thead>
<tr>
<th><em>EAI Categories</em></th>
<th><strong>Maximum BREQ-2 Categories</strong></th>
<th>Amot.</th>
<th>External</th>
<th>Introjected</th>
<th>Identified</th>
<th>Intrinsic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk</td>
<td></td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Symp.</td>
<td></td>
<td>3</td>
<td>2</td>
<td>15</td>
<td>85</td>
<td>128</td>
<td>233</td>
</tr>
<tr>
<td>Asymp.</td>
<td></td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>12</td>
<td>26</td>
<td>51</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6</td>
<td>8</td>
<td>23</td>
<td>103</td>
<td>160</td>
<td>300</td>
</tr>
</tbody>
</table>

* EAI (Exercise Addiction Inventory) is an assessment used to determine those that are at risk for exercise dependency.
** BREQ-2 (Behavioral Regulation in Exercise Questionnaire-2) is an assessment used to determine forms of regulation of exercise behavior. The maximum category determined was the category in which the participant scored the highest. Those who scored equally high in 2 or more categories were excluded from the analysis.

*High risk exercise dependency analyses.* A series of multinomial logistic regressions were run in order to determine if category membership of the EAI and EDS-R could be predicted based on scores from the PRETIE-Q, BREQ-2, and/or the EIS. A breakdown of the independent and dependent variables appear in Table 7. In all cases, the symptomatic group was used as a reference group because this group showed the highest frequencies consistently.
Table 7

Variables Used in the Multinomial Logistic Regression Analyses

<table>
<thead>
<tr>
<th>DV for EDS</th>
<th>DV for EAI</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>At risk</td>
<td>High risk</td>
<td>PRETIE-Q</td>
</tr>
<tr>
<td>Non-dependent symptomatic</td>
<td>Symptomatic</td>
<td>Preference</td>
</tr>
<tr>
<td>Non-dependent asymptomatic</td>
<td>Asymptomatic</td>
<td>Tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BREQ-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amotivation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>External regulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introjected Regulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Identified Regulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intrinsic Regulation</td>
</tr>
</tbody>
</table>

To determine which, if any, independent variable(s) could predict category membership within the EDS-R, 423 cases were analyzed. The full model significantly predicted category membership within the EDS-R (chi square = 224.53, df = 16, p < .0005). The goodness of fit was supported by the values not significantly differing from the observed values [Pearson (chi square = 865.41, df = 828, p = .18), deviance (chi square = 354.80, df = 828, p = 1.0)]. The total score on the EIS significantly predicted category membership within the at-risk category of the EDS-R, $b = .35$, Wald $X^2(1) = 17.93$, $p < .0005$, and also significantly predicted category membership within the non-dependent asymptomatic category, $b = -.18$, Wald $X^2(1) = 35.40$, $p < .0005$. The EIS significantly contributed to the prediction of category membership within the EDS-R. No
categories within the BREQ-2 or the PRETIE-Q significantly contributed to the category membership prediction, \( p > .05 \).

The second analysis was performed to determine which, if any, independent variables could predict category membership within the EAI. A total of 423 cases were analyzed and the full model significantly predicted category membership within the EAI (chi square = 221.15, df = 16, \( p < .0005 \)). Goodness of fit is questionable due to the differing test results for Pearson and deviance [Pearson (chi square = 942.373, df = 828, \( p = .003 \)), deviance (chi square = 371.02, df = 828, \( p = 1.00 \))]. The total score on the EIS significantly predicted category membership within the high risk category of the EAI, \( b = .107, \text{ Wald } X^2(1) = 4.69, p = .03 \) and also significantly predicted category membership within the asymptomatic category, \( b = -.116, \text{ Wald } X^2(1) = 16.14, p < .0005 \). The BREQ-2 categories of amotivation (\( b = 1.35, \text{ Wald } X^2(1) = 4.85, p = .03 \)) and introjected regulation (\( b = 1.31, \text{ Wald } X^2(1) = 17.31, p < .0005 \)) both significantly predicted membership of the high risk category for the EAI. After reviewing the data, lower amotivation category classification of the BREQ-2 (which reflects greater motivation) significantly contributed to the prediction of the high risk category within the EAI. No other categories within the BREQ-2 or the PRETIE-Q significantly contributed to the category membership prediction, \( p > .05 \).

Results – Part B

Demographics. The second part to this study consisted of comparing feeling states of the workouts for 6 days/sessions. These sessions consisted of two involving the participant’s regular workout, two involving an assigned workout, and two involving no workout at all. Averages for both days were used to minimize error. These participants
had to qualify for the second portion of the study by falling into both or either of the at-risk category of the EDS-R and or the high risk category of the EAI (n = 5). The EFI was filled out at four separate times during those six days/sessions to monitor feeling states.

Table 8 provides general demographics along with descriptive statistics for these participants. This college aged population (M = 21.80, SD = 5.22) was highly active (M = 5.60, SD = .89) and exercised at a high intensity level (M = 8.0, SD = .89). Of the participants 40% were males and 60% were females.

Table 8

*Demographic Characteristics of Participants and Descriptive Statistics from Part B of Study*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18</td>
<td>31</td>
<td>21.80</td>
<td>5.22</td>
</tr>
<tr>
<td>#Days of Exercise</td>
<td>4</td>
<td>6</td>
<td>5.60</td>
<td>0.89</td>
</tr>
<tr>
<td>*Intensity of Exercise</td>
<td>7</td>
<td>10</td>
<td>8.00</td>
<td>1.23</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2</td>
<td>40.00</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>60.00</td>
</tr>
<tr>
<td>Preferred Type of Exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance Training</td>
<td>1</td>
<td>20.00</td>
</tr>
<tr>
<td>Aerobic</td>
<td>4</td>
<td>80.00</td>
</tr>
</tbody>
</table>

*Intensity of exercise was reported on a scale from 0-10.

**Changes in feeling states.** Separate 3 (condition) x 4 (time of day) repeated-measures ANOVAs were run for each of the 4 subscales of the EFI (physical exhaustion, tranquility, positive engagement, revitalization) in order to determine if there were significant differences among the three different conditions (regular activity, assigned activity, no activity) at four different times of the day (morning, pre-workout/afternoon, post-workout/evening, bed). The following assumptions were tested and met: (a)
independence of observations, (b) normality, and (c) sphericity. The results indicate that the participants did not experience significant changes in physical exhaustion across the three conditions, $F(2, 8) = 2.35, p = .16, \eta^2 = .37$. Means and standard deviations of physical exhaustion across conditions and times can be found in Table 9. The participants experienced significant changes in physical exhaustion across time, $F(3, 12) = 4.06, p = .03, \eta^2 = .50$. [First time ($M = 5.90, SE = 1.22$), second time ($M = 5.93, SE = 1.16$), third time ($M = 6.33, SE = .88$), fourth time ($M = 8.83, SE = .29$)]. Post hoc tests however did not reveal specific differences among the time periods.

Table 9

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg. Workout – Morning</td>
<td>4.80</td>
<td>3.63</td>
</tr>
<tr>
<td>Reg. Workout – Pre-Workout</td>
<td>5.20</td>
<td>2.84</td>
</tr>
<tr>
<td>Reg. Workout – Post-Workout</td>
<td>5.60</td>
<td>2.97</td>
</tr>
<tr>
<td>Reg. Workout – Bed</td>
<td>8.40</td>
<td>0.41</td>
</tr>
<tr>
<td>Assign. Workout – Morning</td>
<td>6.80</td>
<td>2.56</td>
</tr>
<tr>
<td>Assign. Workout – Pre-Workout</td>
<td>6.80</td>
<td>2.20</td>
</tr>
<tr>
<td>Assign. Workout – Post-Workout</td>
<td>6.60</td>
<td>3.07</td>
</tr>
<tr>
<td>Assign. Workout – Bed</td>
<td>8.90</td>
<td>0.74</td>
</tr>
<tr>
<td>No Workout – Morning</td>
<td>6.10</td>
<td>2.43</td>
</tr>
<tr>
<td>No Workout – Afternoon</td>
<td>5.80</td>
<td>3.05</td>
</tr>
<tr>
<td>No Workout – Evening</td>
<td>6.80</td>
<td>2.44</td>
</tr>
<tr>
<td>No Workout – Bed</td>
<td>9.20</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Participants did however experience significant changes in tranquility across the three conditions, $F(2, 8) = 6.16, p = .02, \eta^2 = .61$. Means and standard deviations of tranquility across conditions and times can be found in Table 10. The results indicate specifically that significant differences occurred from regular workouts ($M = 8.58, SE = .49$) to their assigned workouts ($M = 7.1, SE = .53$) ($p = .06$) and their regular workout ($M = 8.58, SE = .49$) to no workout ($M = 7.28, SE = .60$) ($p = .05$). No significant differences
between the assigned workout \((M = 7.10, SE = .53)\) and no workout \((M = 7.28, SE = .60)\) were found. These changes were consistent within each day as no significant changes in tranquility were found among the four times, \(F(3,12) = .262, p = .85\).

Table 10

Means and Standard Deviations of Tranquility Across Conditions and Times

<table>
<thead>
<tr>
<th>Variable</th>
<th>(M)</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg. Workout – Morning</td>
<td>8.40</td>
<td>1.98</td>
</tr>
<tr>
<td>Reg. Workout – Pre-Workout</td>
<td>8.10</td>
<td>1.56</td>
</tr>
<tr>
<td>Reg. Workout – Post-Workout</td>
<td>9.20</td>
<td>1.92</td>
</tr>
<tr>
<td>Reg. Workout – Bed</td>
<td>8.60</td>
<td>1.34</td>
</tr>
<tr>
<td>Assign. Workout – Morning</td>
<td>7.90</td>
<td>1.29</td>
</tr>
<tr>
<td>Assign. Workout – Pre-Workout</td>
<td>5.90</td>
<td>1.64</td>
</tr>
<tr>
<td>Assign. Workout – Post-Workout</td>
<td>6.70</td>
<td>2.25</td>
</tr>
<tr>
<td>Assign. Workout – Bed</td>
<td>7.90</td>
<td>2.61</td>
</tr>
<tr>
<td>No Workout – Morning</td>
<td>7.00</td>
<td>2.18</td>
</tr>
<tr>
<td>No Workout – Afternoon</td>
<td>7.80</td>
<td>2.17</td>
</tr>
<tr>
<td>No Workout – Evening</td>
<td>7.60</td>
<td>1.78</td>
</tr>
<tr>
<td>No Workout – Bed</td>
<td>6.70</td>
<td>.45</td>
</tr>
</tbody>
</table>

Participants also experienced significant changes in revitalization across the three conditions, \(F(2,8) = 5.64, p = .03, \eta^2 = .59\). Means and standard deviations of revitalization across conditions and times can be found in Table 11. The results indicated specifically that there were significant differences at the \(p < .1\) level when comparing revitalization from participant’s regular workout \((M = 7.25, SE = .61)\) to their assigned workout \((M = 5.78, SE = .28)\) \((p = .08)\) and their regular workout \((M = 7.25, SE = .61)\) to no workout \((M = 5.48, SE = .79)\) \((p = .05)\). However, there was no significant difference between the assigned workout \((M = 5.78, SE = .28)\) and no workout \((M = 5.48, SE = .79)\) in regards to revitalization. Therefore, the results suggest that a person feels more revitalized when able to take part in their regular workout. The participants did experience significant changes in revitalization across time at the \(p < .1\) level, \(F(3,12) = \)
2.62, \( p = .099 \), \( \eta^2 = .40 \). First time (\( M = 5.93 \), \( SE = .94 \)), second time (\( M = 6.33 \), \( SE = .78 \)), third time (\( M = 7.53 \), \( SE = .82 \)), fourth time (\( M = 4.87 \), \( SE = .48 \)). However, post hoc tests did not reveal specific differences.

Table 11

*Means and Standard Deviations of Revitalization Across Conditions and Times*

<table>
<thead>
<tr>
<th>Variable</th>
<th>( M )</th>
<th>( SD )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg. Workout – Morning</td>
<td>7.30</td>
<td>3.46</td>
</tr>
<tr>
<td>Reg. Workout – Pre-Workout</td>
<td>6.80</td>
<td>2.02</td>
</tr>
<tr>
<td>Reg. Workout – Post-Workout</td>
<td>9.50</td>
<td>1.90</td>
</tr>
<tr>
<td>Reg. Workout – Bed</td>
<td>5.40</td>
<td>1.85</td>
</tr>
<tr>
<td>Assign. Workout – Morning</td>
<td>5.80</td>
<td>1.89</td>
</tr>
<tr>
<td>Assign. Workout – Pre-Workout</td>
<td>5.10</td>
<td>1.39</td>
</tr>
<tr>
<td>Assign. Workout – Post-Workout</td>
<td>7.20</td>
<td>3.25</td>
</tr>
<tr>
<td>Assign. Workout – Bed</td>
<td>5.00</td>
<td>1.70</td>
</tr>
<tr>
<td>No Workout – Morning</td>
<td>4.70</td>
<td>2.08</td>
</tr>
<tr>
<td>No Workout – Afternoon</td>
<td>7.10</td>
<td>2.25</td>
</tr>
<tr>
<td>No Workout – Evening</td>
<td>5.0</td>
<td>2.04</td>
</tr>
<tr>
<td>No Workout – Bed</td>
<td>4.20</td>
<td>1.64</td>
</tr>
</tbody>
</table>

The participants did experience significant changes in positive engagement across the three conditions, therefore the results were statistically significant, \( F(2,8) = 4.62, \ p = .05, \ \eta^2 = .54 \). Means and standard deviations of positive engagement across conditions and times can be found in Table 12. The results indicated specifically that there were significant differences at the \( p < .1 \) level when comparing positive engagement from participants regular workout (\( M = 8.01, \ SE = .62 \)) to no workout (\( M = 6.95, \ SE = .38 \)) \( (p = .08) \) However, there was no significant difference between the assigned workout (\( M = 6.90, \ SE = .38 \)) and no workout (\( M = 6.95, \ SE = .38 \)) in regards to positive engagement \( (p > .1) \) or their regular workout (\( M = 8.01, \ SE = .62 \)) to assigned workout (\( M = 6.90, \ SE = .38 \)) \( (p > .1) \). This result was consistent throughout the day, as participants did not
experience any significant changes in positive engagement across time, $F(3,12) = .82, p = .51$.

Table 12

Means and Standard Deviations of Positive Engagement Across Conditions and Times

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reg. Workout – Morning</td>
<td>7.80</td>
<td>2.86</td>
</tr>
<tr>
<td>Reg. Workout – Pre-Workout</td>
<td>7.90</td>
<td>2.33</td>
</tr>
<tr>
<td>Reg. Workout – Post-Workout</td>
<td>9.20</td>
<td>1.89</td>
</tr>
<tr>
<td>Reg. Workout – Bed</td>
<td>7.40</td>
<td>1.14</td>
</tr>
<tr>
<td>Assign. Workout – Morning</td>
<td>7.20</td>
<td>1.15</td>
</tr>
<tr>
<td>Assign. Workout – Pre-Workout</td>
<td>6.10</td>
<td>1.85</td>
</tr>
<tr>
<td>Assign. Workout – Post-Workout</td>
<td>7.70</td>
<td>3.17</td>
</tr>
<tr>
<td>Assign. Workout – Bed</td>
<td>6.60</td>
<td>1.56</td>
</tr>
<tr>
<td>No Workout – Morning</td>
<td>6.00</td>
<td>1.54</td>
</tr>
<tr>
<td>No Workout – Afternoon</td>
<td>8.20</td>
<td>1.68</td>
</tr>
<tr>
<td>No Workout – Evening</td>
<td>7.30</td>
<td>1.68</td>
</tr>
<tr>
<td>No Workout – Bed</td>
<td>6.30</td>
<td>0.76</td>
</tr>
</tbody>
</table>

**Discussion**

An association between the two assessments, the EDS-R and the EAI did emerge and is consistent with past research (Mónok et al., 2012). However, the EAI and EDS-R may be assessing different aspects of exercise dependency. That is, participants may have been classified as at risk on one, but not the other instrument. Previous research has shown similar findings and it has been suggested that the reason is due to the EAI cut-off scores not being empirically based (Mónok et al., 2012). Adams et al. (2012) further suggested that the lack of diagnostic criteria and agreement of the characteristics of exercise dependency may contribute to this measurement issue.

When comparing the EDS-R and the EAI to the BREQ-2, the results suggest that those individuals who were considered to be at risk for exercise dependency tended to be motivated mainly by identified regulation (with some introjected and intrinsic
These results are similar to previous research, which provided evidence that those who were considered to be exercise dependent were more motivated by introjected regulation (Hamer et al., 2002) and identified regulation (Duncan et al., 2010). Overall, it appears that those individuals who are exercise dependent seem to make exercise a part of themselves whether consciously or not in order to maintain a feeling of self and/or self-worth. It is possible that the more a person exercises, the more the exercise becomes part of their identity and therefore, becomes harder to stop.

The more a person self-identifies as an exerciser (reflected by higher EIS scores), the more likely he/she is to fall into the at-risk or high risk category for exercise dependency on both the EDS-R and the EAI. This has been corroborated in past research with similar findings (Murray, McKenzie, Newman, & Brown, 2013). This concept also relates back to the aforementioned finding that a person is more motivated to exercise to a greater extent by internalized factors. As a person increasingly feels that exercising is a part of him or herself the more he or she is motivated to continue to maintain that feeling of self and/or self-worth. This was further supported by the relationship between amotivation and the EAI. Specifically lower scores on the amotivation subscale of the BREQ-2 contributed significantly to the prediction of a person being in the high risk category within the EAI. In other words, as a person shifted from having no motivation for an activity to having some motivation, regardless if it was external in nature, there was a greater likelihood of showing exercise dependent behavior.

Overall, positive feeling states (tranquility, revitalization, and positive engagement) were significantly higher when the participants were able to take part in their regular workouts compared to no workout. This has been shown consistently in
many prior deprivation studies (Aidman & Woollard, 2001; Baekeland, 1970; Hausenblas et al., 2008; Szabó, 1995).

When examining feeling states during participant’s regular workouts compared to their assigned workouts, revitalization and tranquility were significantly higher during their regular workouts. However, there were no significant differences when comparing feeling states during participant’s assigned workouts to no workouts. Even though participants were able to engage in some type of physical activity, the assigned activity did not elicit the same responses as their regular workout. This finding might suggest that an exercise dependent person may respond differently to different types of exercise. A physical argument may be that the release of endorphins is task-dependent and, therefore, an assigned task may not induce the same “feel good” experience as one’s preferred activity (Pierce et al., 2003). Subjectively, it could be argued that the psychological mediator autonomy influences one’s feeling states. As an individual self-initiates the selection of the type, duration, and intensity of an activity, he or she is more likely feel more self-determined (Ryan & Deci, 2000). It should be noted that the decreases in feeling states could possibly be attributed to the fact that they were engaging in an unfamiliar activity with which they were unaccustomed (Gauvin & Rejeski, 1993). While attempts were made in this study to assure that participants felt comfortable, and that the time and environment were not changed, this still could be the case.

Levels of physical exhaustion, the one negative feeling state of the EFI, did not seem to change regardless of the exercise condition. This partially contradicts previous research, which has shown that physical activity causes an increase in energetic arousal (Kanning & Schlicht, 2010). This may be due to the fact that the EFI was completed four
times each day, one being immediately following exercise and the next approximately 4 hours after exercise. It may be possible that a positive change occurred in between those time periods after exercise, but was missed.

Participants did experience significant changes in physical exhaustion and revitalization levels across time. While post hoc tests did not reveal any specific significant changes, an investigation of the means showed higher levels of physical exhaustion and lower levels of revitalization before bedtime compared to other times during the day ($M = 8.83, SE = .29$) and ($M = 4.87, SE = .48$) respectively. This could be due to normal diurnal changes in feeling states, which show that positive mood states are lower in the evening, including awareness/energetic arousal (Kanning & Schlicht, 2010).

Collectively, these results have shed greater clarity on unresolved issues surrounding exercise dependency research. Specifically, it appears that continued attention to the development of a consensus on a definition is needed. This is evident in the inconsistent classification of exercise dependent participants between the EDS-R and the EAI instruments. Moreover, it appears that certain personality traits are more closely aligned with exercise dependent behavior than others. Particularly, a greater sense of exercise self was associated with exercise dependent classification, but not individual differences in preference for or tolerance of exercise intensity. Along the same lines, certain intrinsically-related motivational regulations seem to be closely linked to exercise dependence. Finally, feeling states appear to be sensitive to whether an exercise dependent individual performs his or her normal routine as compared to engaging in a different physical activity or no activity at all.
Chapter 5

Summary, Findings, Conclusions, Implications and Recommendations

Summary

The purpose of the study was twofold in design. One purpose was to examine personality traits using the PRETIE-Q and the EIS, and exercise motivation as measured by the BREQ-2 within an exercise dependent sample. A second purpose was to measure feeling states under different types of physical activity among those who were considered to be at risk for exercise dependency as measured by the EDS-R and the EAI. Participants for the first part of the study included 423 college-aged students (males = 230, females = 193) who each completed a total of 6 surveys. Based on their responses, those who were at risk of exercise dependency according to the EAI and/or the EDS-R while meeting the other qualifications were asked to take part in the experimental portion of the study, which investigated feeling states during different types of physical activity. These participants included 5 college-aged students (males=2, females=3). Statistical analyses revealed that positive feelings were significantly lower when participants completed the assigned activity and abstained from activity completely compared to positive feelings when able to complete their regular workout. Additional analyses showed there was a significant association between those who scored higher on the EIS and the BREQ-2 categories of identified regulation, introjected regulation, and intrinsic regulation and those who were considered at risk for exercise dependency. The PRETIE-Q showed no significant associations with those who were considered to be at high risk for exercise dependency.
Findings

The following general relationships [(a) and (b)] and specific hypotheses (i. – iii.) were tested during this study and the findings (1 – 3) related for the hypotheses are presented as follows:

a) There would be significant associations between the scores on the EAI and the EDS-R with the EIS, PRETIE-Q, and the BREQ-2.

i. There would be a significant positive association between those who were considered at high risk for exercise dependency and exercise identity.

1. Those that identified themselves as an exerciser were more likely to be exercise dependent. Therefore, the initial hypothesis can be accepted.

ii. There would be a significant positive association between those who were considered high risk for exercise dependency and scores on the PRETIE-Q.

2. Preference for and tolerance of physical activity showed no associations with a person being at risk for exercise dependency. Therefore, the original hypothesis must be rejected, and the null hypothesis accepted.

iii. There would be a significant positive association between those who scored higher in the identified regulation and intrinsic regulation on the BREQ-2 and are considered at high risk for exercise dependency.

3. Those that were exercise dependent were motivated more by internal types of regulation including identified and intrinsic regulation and showed lower amounts of amotivation. Thus, the original hypothesis can be accepted.
b) There would be a change in feeling states across the three conditions; preferred activity, assigned activity, and no activity.

i. There would be an increase positive feeling states with preferred activity versus no activity.

1. Positive feelings (tranquility, revitalization, and positive engagement) were highest during a person’s preferred activity compared to no workout. In this case, the initial hypothesis can be accepted.

ii. There would be an increase in positive feeling states with preferred versus an assigned activity.

2. Positive feelings (tranquility, revitalization, and positive engagement) were higher during a person’s preferred activity compared to an assigned activity. Thus, the original hypothesis can be accepted.

iii. There would be an increase in positive feeling states with assigned versus no activity.

3. A positive response on feeling states did not occur during the assigned activity compared to no activity. In this case, the initial hypothesis must be rejected and the null hypothesis must be accepted.

Further findings include the following:

1. Approximately 13% of the population in this study was at risk for exercise dependency.

2. The EDS-R and the EAI are related but may be measuring different aspects of exercise dependency considering all participants were not categorized consistently.
Conclusions

1. The more a person thinks that exercising is a part of him or herself, the more likely they are to become exercise dependent. Essentially, exercise becomes important to their feelings of self-worth and/or values so they continue to exercise to possibly excessive amounts.

2. Those that are exercise dependent are motivated by more internalized factors, which indicates that they continue to exercise to the extent that they do because they believe it is valuable to them and/or their feelings of self-worth.

3. It appears that external factors do not have as much influence on a person who is exercise dependent, indicating that this is a very intrapersonal and complex phenomenon.

4. Considering that positive feeling states increased during a person’s preferred type of activity but no changes occurred between the deprivation day and assigned workout day, positive mood changes may not be caused by physical activity in general but by specific responses during a person’s preferred activity.

5. After analyzing all survey responses, it was revealed that 54 out of 423 participants, or approximately 13%, were considered to be at risk for exercise dependency. It should be noted that participants in this study were taken from a convenient sample of college-aged individuals majoring in exercise science related fields. From these numbers it is clear that exercise dependency is an issue in the world today that should be addressed.

6. The EDS-R and EAI categorized participants differently, which may indicate that these assessments are measuring different aspects of exercise dependency. This most
likely relates back to the confusion surrounding a consistent definition of exercise dependency and the large number of assessments that are available.

7. Overall, exercise dependency is extremely intrapersonal. Therefore, each person may differ in their reasons and/or the underlying causes of exercise dependency. While there may be some motivational, personality, and physiological mechanisms that occur often in those who are exercise dependency, it most likely varies slightly between individuals.

Implications

The primary implications of the current study are focused on the need for greater clarification of the term. In particular, the findings suggest that two commonly used instruments for measuring exercise dependency, the EDS-R and EAI, seem to be measuring different qualities of exercise dependent behavior. While this may be due to the underlying conceptual nature of each questionnaire (i.e. one measures dependency, while the other measures addiction), it nonetheless draws attention to the continued need for additional research to establish an operational consensus of exercise dependency.

As clarification surrounding exercise dependency is achieved, it will improve the approach to identifying those individuals with a predisposition towards exercise dependency. Such results could be useful to psychologists, exercise scientists, medical professionals, fitness specialists, and college health providers by raising awareness of exercise dependency within a college-aged sample. Specifically, these findings further clarify potential causes of exercise dependency and highlight the individual variation that seems central to the concept, such as exercise identity and more intrinsic types of exercise regulation. It appears that each person may have unique responses to different
types of exercise and when an assigned modality is employed it does not appear to elicit
the same responses. Therefore, this may infer that it is not physical activity, per se, that
people may become dependent on but responses that may occur differently in each person
to each type of exercise.

These results could also be used to explore possible treatments for exercise
dependency. The results suggest that it may not be physical activity in general that causes
an increase in positive feelings, which could lead to exercise dependency, but possibly
certain changes that occur during specific types of exercise. Therefore, if a person is
exercise dependent but prefers aerobic activity, part of the treatment could include
resistance training. This approach would allow the person to maintain a healthy level of
physical activity without experiencing mental and possible physical changes that could
contribute to greater dependency. Additionally, it would also be possible to address the
underlying psychological processes of exercise dependency. Understanding why exercise
is critical to the self or the intrinsic drive to exercise may assist in a more balanced
approach to maintaining a physically active lifestyle.

**Recommendations**

Exercise dependency is a complex condition that continues to be difficult to fully
understand. To begin to grasp this concept, researchers should attempt to come to a
consensus on a concise and accurate definition for exercise dependency. While this may
evolve, it should be determined to allow for the development of a universal assessment
which should also be addressed by researchers. The development of both a universal
definition and assessment would limit confusion surrounding this concept.
Research should also continue to explore possible mechanisms for exercise dependency. One way of doing so could include the investigation of different types of physical activity and how they may be associated to exercise dependency. Specifically, further research should compare not only aerobic versus resistance training, but also the volume of exercise (e.g., intensity, duration, and frequency). Studies should attempt to find an equal number of people who prefer resistance training or aerobic activity and examine the relationship within and between the groups based on factors of intensity, duration, and frequency of exercise. Studies could also include those participants who have no preference or enjoy both activities in the control group. Overall, this approach could explore underlying responses that may differ among these types of exercise, which could possibly further clarify exercise dependency on the whole.

Another recommendation to further elucidate the concept of exercise dependency is to conduct a qualitative study to try to reveal themes among those that are considered exercise dependent. At this point, only two qualitative assessments for exercise dependency exist, the EDXI (Bamber, Cockerill, Rodgers & Carroll, 2000) and the EBQ (Loumidis & Wells, 1998). These are not commonly used because each is time consuming and, in general, interviews can be difficult to interpret. However, considering the complex and intrapersonal dynamics of exercise dependency, interviews could reveal commonalities among those who are exercise dependent that may not be apparent from assessments using Likert scales and fixed responses.
References


temperature, mood and performance. Bedford Park, SA. Flinders University of South Australia.


Kohl, H.W., Craig, C. L., Lambert, E.V., Inoue, S., Alkandari, J. R., Leetongin, G., &


Appendix A: Exercise Dependence Questionnaires Table
<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Author(s)</th>
<th>Number of Questions</th>
<th>Response Format</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obligatory Exercise Questionnaire (OEQ)</td>
<td>Pasman &amp; Thompson (1988)</td>
<td>20</td>
<td>4-point Likert</td>
<td>Emotional aspects of exercise; intensity and frequency of exercise; exercise preoccupation</td>
</tr>
<tr>
<td>Commitment to Exercise Scale (CES)</td>
<td>Davis, Brewer, &amp; Ratusny (1993)</td>
<td>8</td>
<td>Continuum with bipolar adjectives</td>
<td>Obligatory exercise; continuous exercise after injury; psychological facets of exercise</td>
</tr>
<tr>
<td>Exercise Dependence Questionnaire (EDQ)</td>
<td>Ogden, Veale, &amp; Summers (1987)</td>
<td>29</td>
<td>7-point Likert</td>
<td>Withdrawal symptoms; exercise for weight control; positive reward; stereotyped behavior; exercise for health reasons; interference with social family-work; insight into problem; exercise for social reasons</td>
</tr>
<tr>
<td>Exercise Beliefs Questionnaire (EBQ)</td>
<td>Loumidis &amp; Wells (1998)</td>
<td>21</td>
<td>Semi-structured interview</td>
<td>Social desirability; physical appearance; mental &amp; emotional functioning; vulnerability to disease &amp; aging</td>
</tr>
<tr>
<td>Bodybuilding Dependency Scale (BDI)</td>
<td>Smith, Hale, &amp; Collins (1998)</td>
<td>9</td>
<td>7-point Likert</td>
<td>Social dependence; training dependence; mastery dependence</td>
</tr>
<tr>
<td>Exercise Dependence Interview (EDXI)</td>
<td>Bamber, Cockrell, Rodgers &amp; Carroll (2000)</td>
<td>0</td>
<td>Interview format</td>
<td>Previous exercise behavior; exercise cognitions / motives for exercise; negative impact on social or occupational aspects of life; injury in exercise; eating attitudes / behaviors; personal insight into exercise dependence; psychological illness and treatment history</td>
</tr>
<tr>
<td>Exercise Orientation Questionnaire (EOQ)</td>
<td>Yates, Edman, Crago, &amp; Crowell (2001)</td>
<td>27</td>
<td>5-point Likert</td>
<td>Self-control; orientation to exercise; self-loathing; weight reduction; competition; identity</td>
</tr>
<tr>
<td>Exercise Dependence Scale-Revised (EDS-R)</td>
<td>Symons Downs, Hausenblas, &amp; Nigg (2004)</td>
<td>21</td>
<td>6-point Likert</td>
<td>Tolerance; withdrawal effects; intention effects; lack of control; time; reduction in other activities; continuance</td>
</tr>
<tr>
<td>Exercise Addiction Inventory (EAI)</td>
<td>Terry, Szabó, &amp; Griffiths (2004)</td>
<td>6</td>
<td>5-point Likert</td>
<td>Salience; mood modification; tolerance; withdrawal; conflict; relapse</td>
</tr>
<tr>
<td>Exercise Dependence Scale (EDS)</td>
<td>Hausenblas &amp; Symons Downs (2002)</td>
<td>29</td>
<td>5-point Likert</td>
<td>Tolerance; withdrawal effects; intention effects; lack of control; time; reduction in other activities; continuance</td>
</tr>
</tbody>
</table>
Appendix B: Etiology of Exercise Dependence Table
<table>
<thead>
<tr>
<th>Category</th>
<th>Proposed Mechanism</th>
<th>Proposed Effect(s)</th>
<th>Research Findings</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological mechanisms</td>
<td>1. Endorphin hypothesis</td>
<td>Exercise intensity dependent release of endogenous opioids (endorphins)</td>
<td>Provides pain relieving effects during high intensity exercise.</td>
<td>Inconclusive</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Colt et al. (1981)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pierce et al. (2003)</td>
</tr>
<tr>
<td></td>
<td>2. Cytokine hypothesis</td>
<td>Excessive exercise produces increased release of psychoimmune neurotransmitters</td>
<td>Not yet tested</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(cytokines), in particular interleukin-6 (IL-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Catecholamine hypothesis</td>
<td>Exercise moderates levels of catecholamines in the body. Chronic exercise results</td>
<td>Exercise results in increased release of catecholamines in the body which maintains an individual’s preferred level of arousal.</td>
<td>Not yet tested</td>
</tr>
<tr>
<td></td>
<td>in adaptive reduction in sympathetic arousal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physiological Mechanisms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Thermogenic</td>
<td>Exercise results in increases in core body temperature.</td>
<td>Increased core body temperature is thought to be related to anxiety like feelings</td>
<td>Inconclusive</td>
<td>Cooke (1983)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and reduced muscle tension.</td>
<td></td>
<td>Reeves et al. (1985); Derronzello et al. (1993)</td>
</tr>
<tr>
<td>Environmental Mechanisms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Sports involvement</td>
<td>Exercise dependency appears to be related to certain types of activities (e.g., running, bodybuilding, dancing) due to the unique demands of the activity.</td>
<td>To achieve a certain level of success, the individual must engage in high levels of training that may lead to exercise dependency over time.</td>
<td>Partial support</td>
<td>Enok &amp; Rudy (1999); Pierce et al. (1993); Hale et al. (2010); Collins et al. (2000); Pierce, Dugan, &amp; McGowan (1993)</td>
</tr>
<tr>
<td>2 Gender</td>
<td>Due to the relationship between exercise dependency and eating disorders, it is thought that gender differences may result in higher exercise dependence.</td>
<td></td>
<td>Inconclusive</td>
<td>Kjellsås et al. (2005)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Zmijewski &amp; Howard (1997)</td>
</tr>
<tr>
<td>Psychological Mechanisms</td>
<td>In support</td>
<td>No support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1. Affect regulation hypothesis</td>
<td>Inability to exercise causes negative affective feelings. Thus, an individual becomes dependent on exercise as a means of alleviating negative affect.</td>
<td>Exercise is used to reduce feelings of negative affect.</td>
<td>Cooke (1983)</td>
<td>Haner et al. (2002)</td>
</tr>
<tr>
<td>2. Cognitive appraisal hypothesis</td>
<td>As stress levels increase, an individual is more likely to become dependent on exercise to cope with stress.</td>
<td>Exercise becomes primary coping mechanism for regulating stress levels.</td>
<td>Not yet tested.</td>
<td>Ansel (1991)</td>
</tr>
<tr>
<td>3. Anorexia analogue hypothesis</td>
<td>Exercise is an alternative to anorexia nervosa and other eating disorders.</td>
<td>Excessive exercise is used for weight management purposes solely</td>
<td>Incoclusive</td>
<td>Yates et al. (1983); Coen &amp; Ogles (1993)</td>
</tr>
<tr>
<td>4. Motivation factors</td>
<td>As an individual shifts from more extrinsic to more intrinsic forms of motivation, she is more likely to become dependent on exercise due to increased feelings of pleasure or reward.</td>
<td>Exercise dependency may depend on individuals having a more intrinsic form of exercise motivation.</td>
<td>Partial support</td>
<td>Haner et al. (2002); Ducan et al. (2010)</td>
</tr>
<tr>
<td>5. Personality factors</td>
<td>Numerous personality traits are thought to dispose an individual towards excessive exercise. (See below for an incomplete list of proposed personality traits)</td>
<td></td>
<td>Partial support</td>
<td>Hall et al. (2007); Hagan &amp; Husmenblad (2003)</td>
</tr>
</tbody>
</table>
Appendix C: Institutional Review Board Approval Letter
MEMORANDUM

To: Chelsea Norton
   Erik Lind

From: Jena Curtis, Chair
       Institutional Review Board

Date: 11/9/12

Re: Institutional Review Board Approval

In accordance with SUNY Cortland’s procedures for human research participant protections, the protocol referenced below has been approved for a period of one year.

Title of the study: Exercise Type, Personality Traits, and Motivation Among an Exercise Dependent Sample

Level of review: Expedited

Protocol number: 1012

Project start date: Upon IRB approval

Approval expiration date: 11/9/13

*Note: Please include the protocol expiration date to the bottom of your consent form and recruitment materials.

For more information about continuation policies and procedures, visit www.cortland.edu/irb/Applications/continuations.html

The federal Office for Research Protections (ORHP) emphasizes that investigators play a crucial role in protecting the rights and welfare of human subjects and are responsible for carrying out sound ethical research consistent with research plans approved by an IRB. Along with meeting the specific requirements of a particular research study, investigators are responsible for ongoing requirements in the conduct of approved research that include:

- obtaining and documenting informed consent from the participants and/or from a legally authorized representative prior to the individual's participation in the research, unless these requirements have been waived by the IRB;
- obtaining prior approval from the IRB for any modifications of (or additions to) the previously approved research; this includes modifications to advertisements and other recruitment materials, changes to the informed consent or child assent, the study design and procedures, addition of research staff or student assistants, etc. (except those alterations necessary to eliminate apparent immediate hazards to subjects which are then to be reported by email to irb@cortland.edu within three days);
- providing to the IRB prompt reports of any unanticipated problems involving risks to subjects or others;
- notifying the IRB of continued research under the approved protocol to keep the records active; and,
- maintaining records as required by the HHS regulations and NYS State law, for at least three years after completion of the study.
In the event that questions or concerns arise about research at SUNY Cortland, please contact the IRB by email irb@cortland.edu or by telephone at [507] 753-1511. You may also contact a member of the IRB who possesses expertise in your discipline or methodology, visit [http://www.cortland.edu/irb/members.html](http://www.cortland.edu/irb/members.html) to obtain a current list of IRB members.

Sincerely,

[Signature]

Jena Curns, Chair
Institutional Review Board
SUNY Cortland
Appendix D: Informed Consent for Part A of Study
1) You are being asked to participate in a study. This study has two parts to it. Part A of this study will look to see if personality and motivation levels are related to exercise dependence (when you do a lot of exercise every day). This study will only involve college students. Part A will include 6 questionnaires. If you agree to participate, you will be asked to first fill out basic demographic information (e.g., your name and age) and then you will be asked to complete the 6 questionnaires.

These questionnaires will have questions that ask you about your personality and levels of motivational as each relates to exercise behavior. Completing the demographic information and questionnaires will take approximately 20 minutes. This series of questionnaires will have questions that ask about your exercise and eating habits, which may be bad for your health. If at any point you are concerned about your eating and/or exercise habits please contact the counseling center of SUNY Cortland by phone (607) 753-4728 or in person at Van Hoesen Hall, Room B-44 for free, confidential help.

Specific instructions for completing each questionnaire will be made available throughout the survey. All responses will remain confidential, which means that no one will see your responses expect the primary researcher. Any material that may identify you will be stored separately from your responses to decrease any confidentiality risks. Part A of the study may show that you have personality traits and motivational factors that may relate to exercise dependency. Based on your responses, you may have the option to participate in a brief follow-up study consisting of approximately 1 week of physical activity. If this is the case, you will be contacted using the email or cell phone information you provide.
For more information about this study please contact Chelsea Norton by phone (518) 320-6126 or email chelsea.norton@cortland.edu. For more information about research at SUNY Cortland or information about the rights of research participants, please contact the Institutional Review Board by email irb@cortland.edu, by phone (607) 753-2511. Participation in this study is voluntary and if, at any time, you want to discontinue participation, there will be no penalty or loss of benefits. You are able to stop participation at any time without penalty.

Do you agree to participate?

( ) Yes

( ) No

Thank You!
Appendix E: Informed Consent for Part B of Study
INFORMED CONSENT DOCUMENT

Title of Study:

Investigators:
Chelsea Norton*  
685 MacElroy Rd  
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Tel. (518) 320-6126  
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Erik Lind, Ph.D.**  
Assistant Professor  
1161 PRST Building  
Department of Kinesiology  
SUNY-Cortland  
Cortland, NY 13045  
Tel. (607) 753-2189  
E-mail: erik.lind@cortland.edu

*Principal investigator  
**Faculty mentor who will supervise the study and oversee its completion.

This is a research study. Please take your time in deciding if you would like to participate.  
Please feel free to ask questions at any time.

INTRODUCTION

The purpose of this study is to examine feeling states under different types of physical activity among those who are considered to be exercise-dependent.

DESCRIPTION OF PROCEDURES

Those participants that are identified and choose to participate in this study will be placed into groups based on their preferred modality of physical activity (as determined on the demographic sheet completed in Part A of the study). This will consist of two generalized groups: resistance training or cardiovascular training. A participant will be considered to prefer resistance training if 80% or greater of his or her total training time is spent on resistance training-type physical activity. Conversely, a participant will be considered to prefer cardiovascular training if 80% or greater of his or her total training time includes cardiovascular-type (e.g., walking, jogging, running, cycling) physical activity. At this point, identified participants will be randomly assigned to a sequence of training activities that they will be asked to adhere to for 8 sessions of exercise. The 8 sessions will include a total of 2 days of the participant’s preferred modality of physical activity (resistance training or cardiovascular training), 2 days of an assigned (i.e., opposite) modality of physical activity (e.g., if the preferred mode is cardiovascular-type physical activity, the participant will engage in resistance training-type physical activity), and 2 days of no physical activity (e.g., exercise deprivation).

To ensure understanding and safety of the participants, they will be asked to attend an information meeting with a certified fitness trainer prior to the start of the 8 sessions to go over the assigned activity and explain exactly how to complete the activity and any set up that may be required of equipment. During the meeting participants will also be asked to complete an informed consent for Part B of the study as well as the Physical Activity Readiness Questionnaire (PAR-Q), which will be collected by the primary investigator.
It should be noted that participants will only complete physical activity on the days and times they normally would engage in their preferred activity. For example, if participants only train on Monday, Wednesday, and Friday, they will only be asked to train on those days.

Throughout the ~1 week period (6 total sessions), participants will be asked to respond to the Exercise-induced Feeling Inventory (EFI). A packet with a sufficient number of the inventories will be provided to each participant. The participants will be asked to complete this inventory at 4 designated times each day. The designated times correspond to the following: (a) within 30 minutes of waking up, (b) no more than 5 minutes pre-exercise, (c) no more than 5 minutes post-exercise, and (d) no more than 30 minutes before bed. On days when the participants will not be engaging in any exercise, they will be asked to fill out the survey (a) within 30 minutes of waking up, (b) approximately 4 hours following that time, (c) 4 hours after the second survey completion, and (d) no more than 30 minutes before bed.

Each participant will also be asked to record information following the assigned type of exercise. For the people having resistance training assigned they will need to report the amount of weight or resistance used for all exercises performed and their rate of perceived exertion (RPE) of the workout as a whole. For the participants having cardiovascular training assigned they will record as much information as possible based on the stationary bicycle used including (a) time, (b) distance, (c) levels of resistance, (d) heart rate, (e) speed, (f) revolutions per minute, and (g) watts, and their perceived exertion (RPE) of the workout as a whole. Once the participant has completed all 6 sessions, all packets and information will be collected by the primary investigator.

RISKS
To prevent confidentiality risk during the initial survey portion of the study, all subjects will be assigned a random number, which will be used for the duration of the study. All information collected that may include identifiable characteristics of the participants will be stored separately from the responses on the surveys and questionnaires. Engaging in physical activity may cause physical sensations that are typically felt during exercise, such as an increase in heart rate, increased ventilation, and possible muscle soreness. Participants will choose a self-selected intensity for all physical activity to minimize this risk.

Throughout the experiment, participants should discontinue exercise if they feel any abnormal sensations or discomfort beyond what is expected.

BENEFITS
It is hoped that the information obtained during this study will benefit society by providing valuable information on exercise dependency. This could be accomplished by helping to establish what influences different types of physical activity may have on feeling states of a person who is exercise dependent.

COSTS AND COMPENSATION
You will not have any costs from participating in this study.

PARTICIPANT RIGHTS
Your participation in this study is completely voluntary and you may refuse to participate or leave the study at any time. If you decide to not participate in the study or leave the study early, it will not result in any penalty or loss of benefits to which you are otherwise entitled.

1164 Professional Studies Building • P.O. Box 2000 • Cortland, NY 13045-0900
Phone: (607) 753-4300 • Fax: (607) 753-5596
CONFIDENTIALITY

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies (the National Institutes of Health) and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

To ensure confidentiality to the extent permitted by law, your name and other identifying information will be permanently erased once the collected data have been tabulated and entered in a computer for statistical analysis. Thus, there will be no traceable connection between your name and your data. Until the data are tabulated, your records will be kept in a room that will be locked at all times and only the researchers will have access to it. If the results are published, your identity will remain confidential.

QUESTIONS OR RESOURCES

You are encouraged to ask questions at any time during this study. For further information about the study, contact Dr. Erik Lind (1151 Professional Studies Building, 607-753-2159, erik.lind@cornell.edu) or Chelsea Norton (607 MacElroy Rd, Ballston Lake, NY 12019, 518-320-6126, chelsea.norton@cornell.edu). If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (607) 753-2511, IRB@cornell.edu, Miller Building, Room 402, PO Box 2000, Cortland, NY 13045-0900.

Questions from Part A may have discussed disordered eating behaviors such as anorexia nervosa and bulimia nervosa and Part B will address your exercise habits, which may be bad for your health. If at any point you are concerned about your eating and/or exercise habits please contact the counseling center of SUNY Cortland by phone (607) 753-4728 or in person at Van Hoeven Hall, Room B-44 or the health center of SUNY Cortland by phone (607) 753-4811 or in person at Van Hoeven Hall, Room B-26 for free, confidential help.

-----------------------------------------------------------------------------------

1104 Professional Studies Building • P.O. Box 2000 • Cortland, NY 13045-0900
Phone: (607) 753-4300 • Fax: (607) 753-5595
PARTICIPANT SIGNATURE

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study.

Participant’s Name (printed) __________________________________________

_________________________ (Participant’s Signature) _______________________

_________________________ (Date) _______________________________________

INVESTIGATOR STATEMENT

I certify that the participant has been given adequate time to read and learn about the study and all of their questions have been answered. It is my opinion that the participant understands the purpose, risks, benefits and the procedures that will be followed in this study and has voluntarily agreed to participate.

_________________________ (Signature of Person Obtaining Informed Consent) _______________________

_________________________ (Date) _______________________________________

1164 Professional Studies Building • P.O. Box 2000 • Cortland, NY 13045-0900
Phone: (607) 753-4300 • Fax: (607) 753-5396
Appendix F: Physical Activity Readiness Questionnaire (PAR-Q)
Par- Q & You

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
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1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

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2. Do you feel pain in your chest when you do physical activity?

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3. In the past month, have you had chest pain when you were not doing physical activity?

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4. Do you lose your balance because of dizziness or do you ever lose consciousness?

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5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?

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</table>

6. Is your doctor currently prescribing drugs (for example, water pills) for you blood pressure or heart condition?

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7. Do you know of any other reason why you should not do physical activity?

<p>| | |</p>
<table>
<thead>
<tr>
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</table>

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME_______________________________________

SIGNATURE_____________________________________

DATE________________________
Appendix G: Demographic Profile and Series of Questionnaires for Part A of Study
Demographics

1) Name*

____________________________________________

2) Age*

____________________________________________

3) Email*

____________________________________________________________________________________

4) Are you currently a National Collegiate Athletic Association sanction athlete?*
   ( ) Yes ( ) No

5) Do you smoke?*
   ( ) Yes ( ) No

6) Average days per week you engage in physical activity*
   ( ) 0 ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 ( ) 6 ( ) 7

7) The average intensity of my workout on a scale from 1-10 would be*
   ( ) N/A ( ) 1-Very light ( ) 2 ( ) 3 ( ) 4 ( ) 5-Moderate ( ) 6 ( ) 7 ( ) 8 ( ) 9 ( ) 10-Very hard
The Eating Attitudes Tests (EAT-26)

1) I am terrified about being overweight.*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

2) I avoid eating when I am hungry.*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

3) I find myself preoccupied with food.*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

4) I have gone on eating binges where I feel that I may not be able to stop. *
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

5) I cut my food into small pieces. *
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

6) I am aware of the calorie content of foods that I eat. *
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

7) I particularly avoid food with high carbohydrate content (i.e. bread, rice, potatoes, etc.).*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

8) I feel that others would prefer if I ate more.*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

9) I vomit after I have eaten.*
   ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

10) I feel extremely guilty after eating.*
    ( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

11) I am preoccupied with a desire to be thinner.*
12) I think about burning up calories when I exercise.*

13) Other people think that I am too thin.*

14) I am preoccupied with the thought of having fat on my body.*

15) I take longer than others to eat my meals.*

16) I avoid foods with sugar in them.*

17) I eat diet foods.*

18) I feel that food controls my life.*

19) I display self-control around food.*

20) I feel that others pressure me to eat.*

21) I give too much time and thought to food.*

22) I feel uncomfortable after eating sweets.*
23) I engage in dieting behavior. *
( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

24) I like my stomach to be empty. *
( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

25) I have the impulse to vomit after meals. *
( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never

26) I enjoy trying new rich foods.*
( ) Always ( ) Usually ( ) Often ( ) Sometimes ( ) Rarely ( ) Never
Exercise Identity Scale (EIS)

1) I consider myself an exerciser.*

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

2) When I describe myself to others, I usually include my involvement in exercise. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

3) I have numerous goals related to exercising. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

4) Physical exercise is a central factor to my self-concept. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

5) I need to exercise to feel good about myself. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

6) Others see me as someone who exercises regularly. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

7) For me, being an exerciser means more than just exercising. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

8) I would feel a real loss if I were forced to give up exercising. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree

9) Exercising is something I think about often. *

Strongly disagree ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5 Strongly agree
Exercise Dependence Scale - Revised (EDS-R)

1) My level of exercising makes me tired at work*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

2) After an exercise session I feel happier about life*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

3) If I cannot exercise I feel irritable*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

4) The rest of my life has to fit in around my exercise*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

5) After an exercise session I feel less anxious*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

6) I exercise to look attractive*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

7) I sometimes miss time at work to exercise*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

8) After an exercise session I feel that I am a better person*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

9) If I cannot exercise I feel agitated*
   ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

10) I exercise to meet other people*
    ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

11) I hate not being able to exercise*
    ( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree
12) I exercise to keep me occupied*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

13) If I cannot exercise I feel I cannot cope with life*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

14) I exercise to control my weight*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

15) I have little energy for my partner, family, and friends*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

16) Being thin is the most important thing in my life*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

17) I feel guilty about the amount I exercise*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

18) I exercise to be healthy*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

19) After an exercise session I feel thinner*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

20) My level of exercise has become a problem*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

21) I make a decision to exercise less but cannot stick to it*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

22) I exercise for the same amount of time each week*
( ) Strongly disagree ( ) ( ) ( ) ( ) ( ) Strongly agree

23) After an exercise session I feel more positive about myself*
24) My weekly pattern of exercise is repetitive*

25) My pattern of exercise interferes with my social life*

26) I exercise to feel fit*

27) My exercising is ruining my life*

28) I exercise to prevent heart disease and other illnesses*

29) If I cannot exercise I miss the social life*
Preference for and Tolerance of the Intensity of Exercise

Questionnaire (PRETIE-Q)

1) Feeling tired during exercise is my signal to slow down or stop.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

2) I would rather work out at low intensity levels for a long duration than at high-intensity levels for a short duration.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

3) During exercise, if my muscles begin to burn excessively or if I find myself breathing very hard, it is time for me to ease off.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

4) I’d rather go slow during my workout, even if that means taking more time.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

5) While exercising, I try to keep going even after I feel exhausted.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

6) I would rather have a short, intense workout than a long, low-intensity workout.*
   ( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree
7) I block out the feeling of fatigue when exercising. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

8) When I exercise, I usually prefer a slow, steady pace. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

9) I'd rather slow down or stop when a workout starts to get too tough. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

10) Exercising at a low intensity does not appeal to me at all. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

11) Fatigue is the last thing that affects me when I stop a workout; I have a goal and stop only when I reach it.*
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

12) While exercising, I prefer activities that are slow-paced and do not require much exertion. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

13) When my muscles start burning during exercise, I usually ease off some. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree
14) The faster and harder the workout, the more pleasant I feel. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

15) I always push through muscle soreness and fatigue when working out. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree

16) Low-intensity exercise is boring. *
( ) I totally disagree ( ) I disagree ( ) I neither agree nor disagree ( ) I agree ( ) I totally agree
Exercise Addiction Inventory (EAI)

1) Exercise is the most important thing in my life*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree

2) Conflicts have arisen between me and my family and/or my partner about the amount of exercise I do*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree

3) I use exercise as a way of changing my mood (e.g. to get a buzz, to escape etc.)*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree

4) Over time I have increased the amount of exercise I do in a day*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree

5) If I have to miss an exercise session I feel moody and irritable*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree

6) If I cut down the amount of exercise I do, and then start again, I always end up exercising as often as I did before*
   ( ) Strongly disagree ( ) ( ) Neither agree nor disagree ( ) ( ) Strongly agree
The Behavioral Regulation in Exercise Questionnaire-2

(BREQ-2)

1) I exercise because other people say I should*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

2) I feel guilty when I don't exercise*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

3) I value the benefits of exercise*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

4) I exercise because it's fun*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

5) I don't see why I should have to exercise*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

6) I take part in exercise because my friends/family/partner says I should*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

7) I feel ashamed when I miss an exercise session*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

8) It's important to me to exercise regularly*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

9) I can't see why I should bother exercising*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

10) I enjoy my exercise sessions*

( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me
11) I exercise because others will not be please with me if I don't*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

12) I don't see the point in exercising*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

13) I feel like a failure when I haven't exercised in a while*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

14) I think it is important to make the effort to exercise regularly*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

15) I find exercise a pleasurable activity*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

16) I feel under pressure from my friends/family to exercise*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

17) I get restless if I don't exercise regularly*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

18) I get pleasure and satisfaction from participating in exercise*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me

19) I think exercising is a waste of time*
( ) Not true for me ( ) ( ) Sometimes true for me ( ) ( ) Very true for me
Appendix H: Exercise-induced Feeling Inventory (EFI) for Part B of Study
**EXERCISE-INDUCED FEELING (EFI) INVENTORY**

**Instructions:**
Please use the following scale to indicate the extent to which each word listed describes how you feel at this moment in time. Record your responses by checking the appropriate box next to each word.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Refreshed</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>2. Calm</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>3. Fatigued</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>4. Enthusiastic</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>5. Relaxed</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>6. Energetic</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>7. Happy</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>8. Tired</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>9. Revived</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>10. Peaceful</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>11. Worn-out</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
<tr>
<td>12. Upbeat</td>
<td>DNF</td>
<td></td>
<td></td>
<td></td>
<td>FVS</td>
</tr>
</tbody>
</table>

0 = Do Not Feel (DNF)
1 = Feel Slightly
2 = Feel Moderately
3 = Feel Strongly
4 = Feel Very Strongly (FVS)
Appendix I. Workout Logs for Assigned Activities
### Resistance Training Log

<table>
<thead>
<tr>
<th>EXERCISE</th>
<th>SET 1</th>
<th>SET 2</th>
<th>SET 3</th>
<th>SET 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Dumbbell Chest Press</td>
<td>12x</td>
<td>12x</td>
<td>12x</td>
<td>12x</td>
</tr>
<tr>
<td>Band Pull Aparts</td>
<td>8x</td>
<td>8x</td>
<td>8x</td>
<td>8x</td>
</tr>
<tr>
<td>Walking Lunges</td>
<td>12x</td>
<td>12x</td>
<td>12x</td>
<td>12x</td>
</tr>
<tr>
<td>Plank</td>
<td>30s</td>
<td>30s</td>
<td>30s</td>
<td>30s</td>
</tr>
<tr>
<td><strong>B</strong> Dumbbell Bicep Curl to Shoulder Press</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
</tr>
<tr>
<td>Box Stup Ups (L/R)</td>
<td>6x each leg</td>
<td>6x each leg</td>
<td>6x each leg</td>
<td>6x each leg</td>
</tr>
<tr>
<td><strong>C</strong> Goblet Squat</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
</tr>
<tr>
<td>Straight Leg Sit Ups</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
</tr>
<tr>
<td><strong>D</strong> Cable Rows</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
</tr>
<tr>
<td>Triceps Pull Downs</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
<td>10x</td>
</tr>
</tbody>
</table>

Note: For each set, the numbers of repetitions have already been recorded. After the I, record the amount of weight lifted, or the resistance used.

### Table S.2A. The original Borg Scale Rating Perception of Effort (RPE)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Perception of effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Very, very light</td>
</tr>
<tr>
<td>7</td>
<td>Very light</td>
</tr>
<tr>
<td>8</td>
<td>Fairly light</td>
</tr>
<tr>
<td>9</td>
<td>Somewhat hard</td>
</tr>
<tr>
<td>10</td>
<td>Hard</td>
</tr>
<tr>
<td>11</td>
<td>Very hard</td>
</tr>
<tr>
<td>12</td>
<td>Very, very hard</td>
</tr>
</tbody>
</table>

*From Borg (1973, p.92). © by Lippincott, Williams & Wilkins. Adapted by permission.*

---

IRB Protocol Number: 121312  
Approval Date: 11/9/12  
Expiration Date: 11/8/13
Cycling Program Log

Name:

Date:

Workout Duration:

Please record as much information as possible that is provided by the stationary bike:

Distance:

Resistance Levels:

Watts:

Cadence (revolutions per minute or RPM):

Heart Rate:

Speed:

Other:

RPE of Workout:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Perception of effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Very, very light</td>
</tr>
<tr>
<td>1</td>
<td>Very light</td>
</tr>
<tr>
<td>2</td>
<td>Fairly light</td>
</tr>
<tr>
<td>3</td>
<td>Somewhat hard</td>
</tr>
<tr>
<td>4</td>
<td>Hard</td>
</tr>
<tr>
<td>5</td>
<td>Very hard</td>
</tr>
<tr>
<td>6</td>
<td>Very, very hard</td>
</tr>
</tbody>
</table>