EFFECTS OF 24 HOURS OF EXERCISE WITHDRAWAL ON MOOD STATES OF INDIVIDUALS HIGH AND LOW ON EXERCISE DEPENDENCE

By

AMY LYNN HAGAN

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by

Amy L. Hagan
This thesis is dedicated to all those few individuals who believed in my ability and perseverance when so many people questioned me. Specifically, this thesis is dedicated to my mom and dad who always listened to my struggles, provided support, and gave an encouraging word even when they were not sure of what I was doing. Additionally, this thesis would have never been accomplished without the support from Sarah Drew and Sue Craven; both of them changed my life forever and helped me discover the freedom that is available to me. I thank them for always believing in me.
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EFFECTS OF 24 HOURS OF EXERCISE WITHDRAWAL ON MOOD STATES OF INDIVIDUALS HIGH AND LOW ON EXERCISE DEPENDENCE

By

Amy Lynn Hagan

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Chairman: Dr. Heather Hausenblas
Major Department: Exercise and Sport Sciences

It has been reported that individuals who are dependent on exercise experience deprivation sensations when exercise is interrupted. The purposes of this study were to determine the following:

- Do exercise-dependent individuals experience mood alterations after 24 hours of exercise deprivation?
- Do motives and reasons to exercise differ between individuals high and low on exercise-dependence symptoms?
- Do physiological differences such as body composition and cardiorespiratory fitness vary between the high and low exercise-dependent groups?

Forty-one undergraduate females, (i.e., 20 low and 21 high exercise-dependence individuals) completed mood measures pre and post exercise and pre and post quiet rest using a repeated measures design. Results showed no mood differences between the high and low exercise-dependent groups after the 24 hours of exercise deprivation. Significant group differences on reasons and motives to exercise were found, with the high group displaying more internal and external motivation and exercising for mood, weight
control, attractiveness, enjoyment, and tone more than the low exercise-dependent group. Finally, the high exercise-dependent group had a lower body composition and a higher level of cardiopulmonary fitness compared to the low exercise-dependent group. Implications of results are discussed in addition to future research directions.
Researchers have consistently found that physical activity results in the improvement of both psychological and physiological health (United States Department of Health and Human Services [USDHHS], 1996, 2000). Because of the numerous benefits associated with exercise and the high prevalence of sedentariness in North America, there is concern by health care professionals and government agencies on how to increase an individual’s activity level (Dishman, 1994; USDHHS, 2000). Facilitating physical activity adoption and adherence, however, continues to remain a challenge given that approximately 40% of American adults are sedentary (USDHHS, 2000), and that 50% of sedentary adults beginning an exercise program drop out within six months (Dishman, 1994).

At the other extreme of the physical activity continuum are individuals who exercise excessively. Paradoxically, their extreme exercise behavior may result in negative psychological and physical consequences. This excessive behavior is termed exercise dependence and it is gaining attention by researchers (Hausenblas & Symons Downs, 2001). Consistent with many psychological constructs, exercise dependence does not have a universal definition (Veale, 1995). It is frequently defined as exercise that is continued in spite of an injury, placed above all other responsibilities (e.g., job and family), and withdrawal or deprivation effects are experienced with a decrease or cessation of exercise (Chan & Grossman, 1988; Szabo, 1995; Veale, 1991).
In this chapter the literature examining exercise dependence and deprivation are reviewed and the study purposes and hypotheses are explained. Specifically, in the first section the explanations for the antecedents of exercise dependence are discussed. In the second section, exercise dependence is defined with a focus on the definitional criterion of withdrawal. The third section reviews studies that investigated the effects of exercise deprivation. Finally, in the fourth section, the purposes of the thesis are stated and the hypotheses are presented.

**Explanations for Dependence**

There are several processes or explanations for the antecedents of exercise dependence. Research support for these explanations however, is limited. Explanations can be classified into psychological, physiological, and psychobiological domains. Research that examined each of these domains is described below.

**Psychological Explanations**

**Personality traits**

The personality trait explanation is based on the belief that pathological personality characteristics such as obsessive-compulsiveness and narcissism are associated with exercise-dependent individuals. For example, Davis, Brewer, and Ratusny (1993) examined relationships among the personality characteristics of addiction, obsessive-compulsiveness, and exercise dependence with exercise behavior. They hypothesized that there would be a positive relationship among the aforementioned personality characteristics and exercise behavior. One hundred and eighty-five male and female physically active participants (M age = 27.82 years) were recruited through ads and fliers in local fitness clubs and newsletters. Participants completed the Commitment
to Exercise Scale (Davis et al., 1993), the Addiction Scale (Eysenck & Eysenck, 1991),
the Obsessive-Compulsive Personality Scale (Lazare, Klerman, & Armour, 1966), and
the Drive for Thinness, Body Dissatisfaction, and Bulimia Subscales of the Eating
Disorder Inventory (Garner, Olmsted, & Polivy, 1983). Participants were also
interviewed about their exercise participation over the past 12 months.

Consistent with their predication, Davis and her colleagues (1993) found that, for
males only, obsessive-compulsive personality characteristics were positively related to
exercise frequency. In contrast to their hypothesis, exercise frequency was negatively
related to addictiveness in males. Also, frequency of exercise was negatively related to
addictiveness in females, although nonsignificant (p = .07). No other study findings were
significant. Thus, the hypothesized positive relationships among obsessive-
compulsiveness, addictiveness, exercise dependence, and exercise behavior were not
supported.

In a similar study Yates and her colleagues (1992) examined the personality
characteristics between obligatory and nonobligatory male and female runners who ran a
minimum of 15 miles per week. According to their responses on an 18-item author-
developed questionnaire and a semi-structured interview that assessed extreme exercise
attitudes and behaviors, the runners were classified as either obligatory or nonobligatory
exercisers. Ten male and 17 female participants were classified as obligatory runners,
while the nonobligatory group comprised 20 males and 19 females. Participants
completed the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1981), the
Eysenck Personality Questionnaire (Eysenck & Eysenck, 1991), the Minnesota
Multiphasic Personality Inventory (Dahlstrom & Welch, 1960), the Bem Sex Role
Inventory (Bem, 1981), the Internal-External Locus of Control Scale (Rotter, 1966), the Eating Attitudes Test (Garner & Garfinkel, 1979), and the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, Erbaugh, 1961).

The researchers found that the obligatory runners were more likely to follow a diet, be preoccupied with their body, run alone, and report more positive changes in self-concept and control over their lives since beginning to run than the nonobligatory runners. Also, the obligatory males were twice as likely to have elevated scores on the Minnesota Multiphasic Personality Inventory compared to the nonobligatory male runners. No other group differences were found between the obligatory and nonobligatory male and female runners.

In a controversial study, Yates and her colleagues (1983) argued that male obligatory runners resembled anorexia nervosa patients on certain personality characteristics (e.g., introversion, inhibition of anger, high expectations, depression, and excessive use of denial) and labeled this relationship as the anorexia-analogue hypothesis. To test their hypothesis they examined the personality characteristics of 60 male excessive exercisers and compared their responses to traditionally reported idiosyncrasies of anorexia nervosa patients. Although no objective data were reported, Yates et al. claimed that running and extreme dieting were both dangerous attempts to establish an identity; that is, to be recognized as either exercise-dependent or anorexic.

Their article was heavily criticized as having no pertinent data, poor methodology, no relevance to the majority of runners, an over-reliance on extreme individuals, and an overstatement of similarities between the groups (Blumenthal, O’Toole, & Chang, 1984). Succeeding empirical research has failed to find a common
psychopathology between exercise-dependents and eating-disorder patients (e.g., Blumenthal et al., 1984; Coen & Ogles, 1993). In short, the anorexia analogue hypothesis is only speculative and has not been fully supported by subsequent research (Coen & Ogles, 1993).

For example, Coen and Ogles (1993) examined the personality characteristics believed to be common to anorexics and runners according to the anorexia analogue hypothesis (e.g., anxiety, perfectionism, and ego identity). The participants were 142 male marathon runners who completed the Obligatory Exercise Questionnaire (Thompson & Pasman, 1991), the Multidimensional Perfectionism Scale (Frost, Marten, Lahart, & Rosenblate, 1990), the Trait Subscale of the State-Trait Anxiety Inventory (Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), the Ego Identity Scale (Tan, Kendis, Fine, & Porac, 1977), and demographic running characteristics. A median split on the Obligatory Exercise Questionnaire was used to classify runners as either obligatory or nonobligatory.

It was found that the obligatory runners reported more perfectionistic characteristics compared to the nonobligatory runners. Specifically, obligatory runners were more concerned about making a mistake, had higher personal standards, more doubts about their actions, and had a higher need for organization than their nonobligatory counterparts. The obligatory runners also reported greater trait anxiety compared to the nonobligatory runners. The authors concluded that the anorexia analogue hypothesis was partially supported because only some of the personality characteristics advanced by Yates et al. (1983) were associated with the obligatory runners.
In contrast to the previous study, Iannos and Tiggemann (1997) failed to find personality differences between exercise-dependent and nondependent individuals. They examined 205 male and female individuals from local gymnasiums. The participants were divided into three groups according to the number of hours they exercised per week: light (n = 69, 0-5 hours), medium (n = 107, 5-11 hours), and excessive (n = 29, 11+ hours). The participants completed an author-developed questionnaire which assessed their level of exercise dependence, the Self-esteem Scale (Rosenberg, 1965), the Internality Subscale of the Locus of Control Inventory (Levenson, 1981), the Obsessive-Compulsive Scale (Gibb, Bailey, Best, & Lambrinth, 1983), and the Drive for Thinness and Bulimia Subscales of the Eating Disorder Inventory. It was found that the excessive exercisers reported more eating disorder behaviors than the light and medium exercisers, with females scoring higher than males. Despite this relationship, no significant differences were found between exercise level and the personality characteristics of self-esteem, locus of control, and obsessive-compulsiveness. Thus, the authors concluded that excessive exercise is not related to a pathological personality.

Finally, Estok and Rudy (1986) examined 57 marathon and 38 nonmarathon female runners (M age = 35.8 years) on physical symptoms (e.g., shin splints and knee or hip pain), psychosocial symptoms (e.g., anxiety and self-esteem), and addictive behaviors using a 14-item author-developed scale. It was found that the marathon runners compared to the nonmarathon runners scored significantly higher on addictive behaviors. The incidence of injuries among marathon runners was significantly higher than in the nonmarathon runners. Although there was no difference between the marathon and nonmarathon groups for psychosocial symptoms, there was a negative association
between addiction and self-esteem. The authors concluded that common running injuries are more a function of the distance run rather than the level of running addiction.

**Affective states**

The affective-states explanation is based on the belief that the improved feeling states associated with acute exercise bouts may result in exercise dependence. The rationale for the affective states hypothesis is that acute exercise results in improvements in levels of depression, anxiety, stress, and mood (Landers & Arent, 2001). It is therefore suggested that exercise-dependent individuals become “dependent” on these positive states and the “euphoria” experienced by exercising.

In accordance with this statement, Sachs and Pargman (1979) suggest that following acute exercise bouts, feelings of relaxation, accomplishment, vigor, and calmness are achieved. They also state that, “the feeling of well being associated with exercising is a strong motivator for continued participation in regular physical activity” (Sachs & Pargman, 1979, p. 145). The belief is that if small doses of exercise produce positive feeling states, then increased activity would result in more positive mood. For example, Morgan (1979) states that, “a drug dosage must be increased across time to create the same quality of sensation, and similarly, exercise duration or intensity (dosage) must also be increased to maintain an exercise high” (p. 63). These sensations are the psychological “euphoria” that individuals feel while exercising. It is suggested that this euphoria can lead to dependence because individuals will exercise at either higher intensities or longer durations to experience the positive effects (Kagan & Squires, 1985; Pierce, 1994; Thompson & Blanton, 1987).

The affective-states explanation for exercise dependence resembles *tolerance*, which is a component of dependence as defined by the Diagnostic and Statistical Manual-
IV (DSM-IV; American Psychological Association [APA], 1994). According to the DSM-IV definition for dependence, tolerance is achieved when there is a “need for greatly increased amounts of the substance to achieve the desired effect or a markedly diminished effect with continued use of the same amount of the substance” (p. 176). When individuals experience tolerance they have adapted to and become familiar with the stimuli or stressor regardless of its negative effects. In regards to exercise, tolerance can develop despite experiencing negative effects such as sore muscles, achy joints, and the requirement of time.

Davis (1999) describes the adaptation to tolerance as following:

It has been said that a metaphoric switch seems to be thrown as a result of prolonged exposure to any reinforcing activity or substance, with the result that a behavior that was once voluntary becomes compulsive and moves into the state of addiction. (p. 222)

Research is needed to examine whether tolerance to exercise occurs for exercise-dependent individuals.

**Physiological Explanations**

Physiological explanations center on the premise that chemical processes that occur in the body during exercise can lead to dependence. These chemicals include epinephrine, norepinephrine, beta-endorphins, and opioids. Gauvin and Rejeski (1993) state that changes occur in the metabolic and nervous systems to promote a physiological desire for exercise. For example, feelings following an acute exercise bout (e.g., refreshed, tranquil) are possibly due to the changing chemical processes in the body (Gauvin & Rejeski, 1993). Furthermore, Scully et al. (1998) state that “mood enhancing and analgesic properties associated with exercise are influenced by chemicals in the brain
that are akin to opiates” (p. 416). The two existing physiological explanations are described in the subsequent sections.

**Beta-endorphin theory of endogenous opioids**

The most common physiological explanations for exercise dependence is the beta-endorphin theory of endogenous opioids (De Coverley Veale, 1987; Thoren, Floras, Hoffman, & Seals, 1990). Beta-endorphins are endogenous compounds that play a role in the transmission of pain impulses by decreasing pain sensitivity. Researchers have shown that beta-endorphin levels in the blood rise with submaximal exercise due to an increased need for blood to be transported to the working muscles (Crossman, Jamieson & Henderson, 1987; Thoren et al., 1990). Based on the physiological processes that occur in the body when beta-endorphin levels rise, an individual could conceivably become dependent on these natural chemicals because they mask pain, thereby allowing individuals to feel better (Crossman et al., 1987). In addition to the analgesic effect, endogenous compounds can produce addictive behavioral tendencies such as compulsive exercise (Pierce, Eastman, Tripathi, Olson, & Dewey, 1993). The opioid peptides produced by the central nervous system however, are impermeable to the blood brain barrier. Because of the impermeability to the barrier, beta-endorphins cannot solely be associated with exercise dependence.

The only located study examining the beta-endorphin hypothesis was undertaken by Pierce and his colleagues (1993). They examined the relationship between beta-endorphin levels after an acute exercise bout with exercise-dependence scores. Participants were eight females who engaged in at least three aerobic classes per week. The Negative Addiction Scale (Hailey & Bailey, 1982) was completed by the participants and blood samples were taken by venipuncture before they engaged in a high-intensity
aerobic session for 45 minutes. Immediately following the aerobic session blood samples were reassessed. Although beta-endorphin levels were elevated after the activity bout, a significant positive correlation between level of exercise dependence and beta-endorphins failed to appear. In short, despite the intuitive appeal of this hypothesis, research support is lacking.

**Sympathetic arousal hypothesis**

Thompson and Blanton (1987) suggest a sympathetic arousal hypothesis to explain exercise dependence (Figure 1.1). In this hypothesis, dependence is attributed to exercise behavior and hormonal changes in epinephrine and norepinephrine. Epinephrine (e.g., adrenaline) and norepinephrine (e.g., noradrenaline) respond to strong emotional stimuli and prepare the body for challenges from the environment (Powers & Howley, 1997). When the body is repeatedly stressed in the same manner it becomes familiar with

![Figure 1.1 - Process of exercise dependence according to the sympathetic arousal hypothesis](image)

Exercise training

Increased exercise performance

Increased efficiency

Lowered sympathetic arousal

Figure 1.1 - Process of exercise dependence according to the sympathetic arousal hypothesis
the stressor, thereby becoming more efficient when responding to the stressor. Energy efficiency is increased causing a change in the dose response, thereby requiring the individual to exercise more to achieve the same arousal level.

The sympathetic arousal hypothesis is based on two components: physiological arousal and the opponent process model. The sympathetic arousal component has been supported with research on depression and the biochemical and psychological effects of exercise (Doyne, Chambless, & Beutler, 1983; Landers & Arent, 2001; Mandenoff, Fumeron, Apfelbaum, & Margules, 1982; Morgan, 1985; Morgan, Roberts, Brand, & Feinerman, 1970). For example, research has found that for depressed individuals, exercise and drug therapy have similar antidepressant effects due to elevation of norepinephrine to a healthy level (Morgan, 1985). Furthermore, individuals who were sedentary prior to experiencing depressive symptoms may alleviate depression by regular exercise (Doyne et al., 1983; Mandenoff et al., 1982).

The second element of this hypothesis stems from the opponent-process model of addiction (Solomon, 1980). This model has three phases: 1) affective hedonic contrast, 2) tolerance, and 3) withdrawal. In the first phase, individuals may experience an affective feeling of pleasure when exercise is performed. Tolerance, the second phase, then occurs with repetition of the exercise. This causes an increased need for either higher intensities or longer durations of exercise to experience the same amount of pleasure or euphoria previously encountered. The last phase, withdrawal, occurs when the activity is terminated or the effort (i.e., intensity) by the individual does not elicit the pleasurable euphoria once felt. Withdrawal then produces an aversive reaction that promotes subsequent exercise in order to diminish the negative effects. No known
studies have examined the existence of the sympathetic arousal hypothesis in explaining exercise dependence possibly due to its complexity.

**Psychobiological Explanations**

A combination of the psychological and physiological domains is referred to as psychobiological. Sachs and Pargman (1979) report that, based on their interviews with 12 male runners, the vital factors in exercise dependence are a combination of the psychological and physiological elements of withdrawal. Subsequently, they developed a two-factor psychobiological model to describe the relationship between running and dependence. The model is based on the degree of commitment and the amount of dependence an individual has acquired (Conboy, 1994; Sachs & Pargman, 1984). The first factor, dependence, is the psychobiologic phenomenon. Commitment, the second factor, is regarded as the cognitive or intellectual phenomenon (Figure 1.2). The model’s premise is that the addicted runner has high commitment and dependence and when

<table>
<thead>
<tr>
<th>Commitment</th>
<th>Dependence</th>
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<tbody>
<tr>
<td>high</td>
<td></td>
<td></td>
<td>Most amount of change from run/no run</td>
</tr>
<tr>
<td>low</td>
<td></td>
<td></td>
<td>Least amount of change from run/no run</td>
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</tbody>
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Figure 1.2 - Sachs and Pargman’s (1984) hypothesized model of runners’ motivation
running deprivation occurs, he or she experiences withdrawal effects. In contrast, a runner with low commitment and high dependence would not experience withdrawal effects for a missed run. Research examining this model however, has not consistently supported the existence of the two factors (Conboy, 1994).

For example, Szabo and his colleagues (1997) attempted to test the model by examining the relationships among addiction, commitment, and deprivation. Committed runners were defined as those who run for extrinsic rewards, view running as an important, but not central, part of their lives, and do not suffer from strong withdrawal symptoms. In comparison, addicted runners were defined as people who are more likely to run for intrinsic rewards, view running as the central part of their lives, and experience strong deprivation sensations when unable to exercise. The authors hypothesized that deprivation effects from running are related to addiction rather than commitment. That is, addicted but not committed runners would report withdrawal effects during no run periods. It was also hypothesized that Type I runners (i.e., the most committed runners) would have higher mileage per week than Type II runners (i.e., committed runners who involve themselves in other activities).

To test their hypotheses, Szabo and his colleagues (1997) recruited 100 male and female participants via an Internet discussion group for runners. The participants completed the Commitment to Running Scale, the Obligatory Exercise Questionnaire, an author-developed scale to examine deprivation sensations, running demographics, and reasons for beginning and maintaining running. The authors found a positive relationship between running addiction and deprivation sensations, as well as the frequency, duration, and distance of the run. In addition, participants who started running for reasons other
than health, but continued for health reasons, experienced the most extreme feelings of deprivation. In comparison, commitment to running was not correlated with the variables examined. In summary, the study results demonstrated that feelings of deprivation are components of addiction, not commitment, to running.

Another psychobiological explanation is the general theory of addiction (Jacobs, 1986) which describes the etiology and course of all addictive behaviors. This theory proposes that there are two predisposing factors which determine if an individual is at-risk of developing an addiction. The first factor is based on the resting physiological tension of the body which is between hypo (excessively depressed) and hyper (extreme excitement). According to this theory for a person to be predisposed to an addictive behavior his or her resting physiological state must be either chronically hypo or hyper. The predisposed second factor is psychological in nature and states that certain social and developmental experiences in childhood (e.g., abandonment, abuse) may result in addictions. It is proposed that addictive behaviors may allow the individual to escape from his or her distressing reality and thereby, experience wish-fulfilling fantasies of being an important person.

Jacobs (1986) proposes that when both of the predisposing factors exist, addictive behavior can be predicted by charting movement through three sequential stages. The first is called the Stage of Discovery and occurs when a high level of positive reinforcement is produced by an experience (which later becomes the addiction). Because of the reinforcement, the behavior is repeated and the individual continues to achieve the relief experienced by the first occurrence. The shift from occasional behaviors to planned, highly motivated, compulsive behaviors (termed overlearning) is
the second stage which is termed **Stage of Resistance**. This resistance is evident when outside efforts to discourage the behavior are rejected and the addicted individual embraces the behavior. Three factors explain the resistance experienced during this time: 1) positive reinforcement from the pleasure experienced from the behavior, 2) extent of overlearning, and 3) avoidance of the return to the previous resting state. This third factor is considered to be the key aspect of the general theory of addiction due to the undesirable resting state.

During the second stage, a reciprocal relationship between positive and negative reinforcement occurs that prepares the individual to enter the third stage. The final stage, **Exhaustion**, is entered when the individual who is emotionally and physically exhausted experiences a rapid breakdown of the addiction and collapses. At this point, the individual is most treatable and able to discontinue the addictive behavior. In the general theory of addiction, the presence of the predisposing conditions and the course of movement through the three stages is known as the **Addictive Personality Syndrome**.

Examining the second criterion of the general theory of addiction, Bamber, Cockerill, and Carroll (2000) tested 291 females recruited from fitness centers and eating disorder clinics. The Exercise Dependence Questionnaire (Ogden, Veale, & Summers, 1997), the Eating Disorder Examination Self-Report Questionnaire (Fairburn & Beglin, 1994), the General Health Questionnaire (Goldberg & Williams, 1988), the Rosenberg Self-Esteem Scale, the Eysenck Personality Questionnaire-Revised (Eysenck & Eysenck, 1991), the Body Shape Questionnaire (Cooper, Taylor, Cooper, & Fairburn, 1987), the Exercise Beliefs Questionnaire (Loumidis & Wells, 1998), and questions assessing menstrual dysfunction, weight dissatisfaction, weight fluctuation, and physical activity
were administered. Based on responses to the Exercise Dependence Questionnaire and the Eating Disorder Examination Self-Report Questionnaire, the participants were divided into one of four groups: (a) exercise-dependent, (b) eating disordered, (c) both exercise-dependent and eating disordered, or (d) neither exercise-dependent nor eating disordered (i.e., control group).

Statistical analysis revealed that the exercise-dependent and exercise-dependent/eating disorder groups experienced a higher percentage of menstrual amenorrhea and irregular menstrual cycles compared to the eating disorder and control groups. The exercise-dependent/eating disorder group scored higher on the General Health Questionnaire compared to the exercise-dependent and control groups, indicating a lower level of overall health. Additionally, the exercise-dependent and control groups scored significantly higher on self-esteem compared to the exercise-dependent and exercise-dependent/eating disorder group. Both the exercise-dependent and exercise-dependent/eating disorder groups demonstrated significantly more concern with body shape and weight dissatisfaction than the other groups. For weight fluctuation however, the exercise-dependent/eating disorder group had the greatest fluctuation compared to the exercise-dependent and control groups but not the eating disorder group.

According to the Eysenck Personality Questionnaire-Revised, no group differences existed for psychoticism, social desirability, and empathy. The control group however demonstrated significantly less neuroticism, addictiveness, and impulsiveness compared to the other three groups. In terms of exercise, the exercise-dependent and exercise-dependent/eating disorder groups exercised significantly more than the eating disorder and control groups. In summary, the exercise-dependence individuals failed to
have the psychological morbidity seen in the eating disorder and the exercise-dependent/eating disorder groups. The authors concluded that exercise dependence, in the absence of an eating disorder, may be a rare occurrence and not a pathology.

**Summary**

Equivocal and limited research exists on the hypotheses that have been advanced to explain exercise dependence. This may, in part, be due to the study designs and measurements. The psychological explanations of personality traits and affective states have typically been measured using self-report measures that have inherent biases such as social desirability and retrospective data collection. The physiological explanations such as the beta-endorphin theory of endogenous opioids and the sympathetic arousal hypothesis have been more difficult to examine. This is because physiological tests often require expensive equipment, trained experts, and are intrusive to the participants. The psychobiological explanations for dependence, such as the two-factor running model and the general theory of addiction, are challenging to test because it is difficult to determine what percentage of dependence can be contributed to psychological versus biological factors. In short, no single explanation for exercise dependence has been supported. It is plausible that a combination of psychological and physiological factors contribute to exercise dependence.

**Defining Exercise Dependence**

As with other addictions, a standard definition of exercise dependence does not exist (Johnson, 1994). Definitions of exercise dependence include behavioral factors (e.g., exercise frequency), psychological factors (e.g., pathological commitment), and physiological factors (e.g., tolerance). The definition that has gained the most
recognition was proposed by DeCoverley Veale (1987; Veale, 1995) who recommends a set of standards for diagnosing exercise dependence based on the DSM-IV criteria for substance dependence, which includes both a biomedical (e.g., tolerance, withdrawal) and psychosocial perspective (e.g., interference with social and occupational functioning; APA, 1994).

Expanding on Veale’s definition, Hausenblas and Symons Downs (2001) recommend, based on the DSM-IV diagnostic criteria for substance dependence (APA, 1994), that exercise dependence be operationalized as a multidimensional maladaptive pattern of exercise, leading to clinically significant impairment or distress, as manifested by three or more of the following: (1) tolerance: which is defined as either a need for significantly increased amounts of exercise to achieve the desired effect or diminished effect with continued use of the same amount of exercise; (2) withdrawal: which is manifested by either withdrawal symptoms for exercise (e.g., anxiety, fatigue) or the same (or closely related) amount of exercise is taken to relieve or avoid withdrawal symptoms; (3) intention effects: which represents exercise that is often taken in larger amounts or over a longer period than was intended; (4) loss of control: which is defined as a persistent desire or unsuccessful effort to cut down or control exercise; (5) time: which reflects that a great deal of time is spent in activities necessary to obtain exercise (e.g., vacations are exercise related); (6) conflict: important social, occupational, or recreational activities are given up or reduced because of exercise; and (7) continuance: exercise is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the exercise (e.g., continued running despite severe shin splints).
Furthermore, it is difficult to determine whether the individual has physiological
dependence (i.e., evidence of tolerance or withdrawal) or no physiological dependence
(i.e., no evidence of tolerance or withdrawal). Future research is required to establish the
utility of this definition and which of the criteria apply to exercise dependence. Table 1-1
adopts the DSM-IV criteria for substance dependence to define exercise dependence.

Focusing on the second criterion of withdrawal, exercise-dependent individuals
should demonstrate withdrawal effects during periods of no physical activity. When
excessive exercisers discontinue exercising for a short period of time, they often
experience depression, fatigue, anxiety, irritability, restlessness, insomnia, frustration,
and guilt (Morgan, 1979; Scully et al., 1998; Szabo, 1995). Szabo (1995) stated that
withdrawal symptoms are the cardinal feature of exercise dependence. Furthermore, he
suggested that additional research is required to study the magnitude of the effects of
exercise deprivation on dependent individuals. In short, it is important to determine
whether withdrawal exists with exercise dependence as it does with other addictions
(APA, 1994).

Finally, it is important to note that DeCoverley Veale (1987; Veale, 1995)
proposed that a diagnostic hierarchy must occur to validly identify exercise dependence.
He argued that the diagnosis of an eating disorder must first be excluded before a
diagnosis of primary exercise dependence can be made. That is, primary exercise
dependence can be differentiated from an eating disorder by clarifying the ultimate
objective of the exerciser. In primary exercise dependence the physical activity is an end
in itself. In contrast, for secondary exercise dependence the compelling motivation for
physical activity is the control and manipulation of body composition.
Table 1-1: Exercise Dependence Criteria

At least three of the following must be present at one time to be considered exercise-dependent:

1. **Tolerance**: as defined by either of the following:
   a) A need for markedly increased amounts of the exercise to achieve the desired effect or
   b) Markedly diminished effect with continued use of the same amount of exercise.

2. **Withdrawal**: as manifested by either of the following:
   a) Characteristic withdrawal symptoms including general fatigue, anxiety, irritability, frustration, and guilt or
   b) The same (or closely related) exercise is done to relieve or avoid withdrawal symptoms.

3. **Intention effects**: the exercise is often performed at higher intensities or over a longer period than was intended.

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

5. **Time**: a great deal of time is spent in preparing to exercise, exercising, or recovering from its effects.

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

7. **Continuance**: exercise is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by exercise.
Review of Exercise Deprivation or Withdrawal Literature

Regardless of the reasons for the deprivation period (e.g., injury, lack of time), exercise-dependent individuals experience withdrawal symptoms. There is growing evidence (Crossman et al., 1987; Gauvin & Szabo, 1992; Mondin et al., 1996; Sachs & Pargman, 1979; Szabo, 1995; Thaxton, 1982) that only 24 hours of deprivation is required to experience withdrawal symptoms; however, deprivation periods can range from 24 hours (Conboy, 1994) to one month (Baekeland, 1970). Research designs of exercise-deprivation investigations include experimental (Thaxton, 1982), quasi-experimental (Baekeland, 1970; Conboy, 1994; Mondin et al., 1996; Morris, Steinberg, Sykes, & Salmon, 1990; Wittig, McConnell, Costill, & Schurr, 1992), correlational (Estok & Rudy, 1986; Harris, 1981a; Szabo, Frenkl, & Caputo, 1996), and prospective studies (Gauvin & Szabo, 1992; Szabo, Frenkl, & Caputo, 1997). Experimental studies are rare in the exercise-deprivation literature. One possible explanation is that experimental deprivation studies are difficult to conduct because most exercise-dependent individuals do not voluntarily stop exercising (Szabo, 1998). Thus, to examine the effects of exercise deprivation, quasi-experimental and correlational studies have been undertaken to a greater extent than experimental designs. Prospective studies have also been developed in which mood is assessed during exercise and no-exercise days. These study designs are described in greater detail in the subsequent sections.

Experimental Studies

Thaxton (1982) examined the effects of 24 hours of exercise deprivation with 33 committed runners (24 males and 9 females). Commitment to running was defined as those who had been averaging five days a week of running for at least one year. Participants completed the POMS and a galvanic skin response test. The POMS
measures six mood states: tension, fatigue, vigor, anger, confusion, and depression. The galvanic skin response test is a physiological measure that assesses skin resistance that is altered by reactions between the autonomic nervous system and a stimulus. The test was used to measure withdrawal-related tension that was indicated by a high resistance reading.

Using the Solomon four-group design and random selection, half of the subjects refrained from running (no-run group) while the remaining participants ran for 30 minutes (run group) during a 24-hour period. Half of the run and no-run groups were pretested using the galvanic skin test. The pretest included counting by seven backwards from a given number for five minutes. A loud motor was added to increase the amount of stress. The galvanic skin test was simultaneously used during this process to record skin resistance. The POMS and galvanic skin response test were administered within a few hours after the 30-minute run or deprivation period, depending on group assignment. It was found that the running-deprived group reported greater depression and stress compared to the no-run group.

In another experimental study, Gauvin and Szabo (1992) employed the experience sampling method. They examined one week of deprivation using various exercise modes. The participants (N = 21; 67% male) were randomly assigned into either an experimental (n = 12) or control group (n = 9). The participants were university students who engaged in at least 3 bouts of exercise a week with a mean of 7.52 hours of exercise per week for the past 4 months. The control group continued their regular exercise routine throughout the five-week study. The experimental group was instructed to stop exercising from Day 15 to 21 (one week) of the study. Each participant was given a
beeper that sounded four times a day for the length of the study. In response to the beep, the participant completed a well-being questionnaire that assessed mood states and physical symptoms (e.g., headache, stomach pain, chest pain, coughing, sore throat, and stiff/sore muscles). It was found that the experimental group reported more physical symptoms during the deprivation period than the control group. No group differences in mood states were evidenced.

**Quasi-Experimental Studies**

Because true experimental deprivation studies are difficult to conduct (Szabo, 1995), there have been a larger number of quasi-experimental studies. Baekeland (1970) conducted the first quasi-experiment examining the effects of exercise-deprivation on mood. He encountered great difficulty recruiting habitual exercisers (i.e., individuals who exercised five to six days a week) who were willing to abstain from exercise for one month. In fact, the habitual runners refused to participate even when monetary incentives were provided. The participants he was able to recruit were 14 males who regularly exercised three to four days per week. During the one-month deprivation period, participants reported decreased psychological well-being (e.g., increased anxiety, nocturnal awakening, sexual tension, and anxiety). In short, Baekeland found that: (1) habitual runners, who ran five to six days a week, refused to interrupt their exercise program for a one-month period; and (2) regular runners, who ran three to four days a week, reported withdrawal symptoms during a one-month exercise-deprivation period.

In a more controlled quasi-experimental study, Morris and colleagues (1990) examined 2-weeks of exercise-deprivation with 40 male runners. For study inclusion, participants had to run 3 times a week for 10 miles a week for at least 3 months. The control group was instructed to continue their regular running over the course of the 6-
week study. The experimental group was asked to stop running for Week three and four during study. The measures used to assess the deprivation effects were the General Health Questionnaire (Goldberg & Williams, 1988) and the Zung Anxiety and Depression Scales (Zung, 1974).

It was found that the deprived runners reported increased anxiety, insomnia, somatic symptoms, social dysfunction, and depression compared to the control group during the exercise-deprivation period. The amount of time to experience the psychological changes was dependent on the variable measured. That is, the General Health Questionnaire subscales of social dysfunction, somatic symptoms, anxiety, and insomnia were present at the end of the first week of deprivation. In comparison, depression and anxiety did not manifest until the end of the second week. The authors suggested that the exercise-deprived individuals were able to cope without running for a week; but after that time, their coping mechanisms failed and depression and anxiety were evident.

In another study using runners, a 4-week reduction in both training intensity and volume was undertaken (Wittig, McConell, Costill, & Schurr, 1992). Ten male adult runners who had been training an average of 14.5 years were examined to determine if exercise reduction, rather than deprivation, had an effect on mood. The participants trained for four weeks at their normal training load (baseline) and then started a 4-week period of reduced training. All participants completed a maximal exercise test to assess their cardiovascular endurance at baseline. The training volume (i.e., mileage per week) was reduced by 66%, frequency (i.e., number of exercise sessions) by 50%, and intensity (i.e., effort) at or below 70% of VO2 max. A 5-kilometer run was performed following
baseline training and after the reduced training-regimen. The POMS was administered before baseline, after baseline, and following the reduced-training period. Increased negative mood was evident from baseline to following the reduced training. This finding demonstrated that reduced exercise volume, frequency, and intensity can alter mood; and that a complete deprivation period may not be required.

Using a measure of dependence, Conboy (1994) examined exercise deprivation and mood states using Sachs and Pargman’s (1984) model of runners’ motivation (Figure 1-2). Subjects were recruited from 5 and 10 km running races and local running clubs. Fifty-one male and 10 female runners completed the POMS, the Commitment to Running Scale, and a question regarding their frequency of running per week. Using the scores from the Commitment to Running Scale, a median split was performed to determine the low and high exercise-dependent groups. The participants did not alter their normal running schedule for the duration of the study. On at least 10 days when they ran and at least 2 days when they did not run, they were required to complete the POMS. The POMS was completed 20-40 min following exercise on run days and on no-run days it was completed 24 hours after the last run.

It was found that exercise deprivation resulted in increased mood disturbance. In contrast to the hypothesis however, the high-commitment and high-dependence runners did not report the greatest withdrawal effect. In fact, individuals scoring low on commitment and high on dependence reported the greatest mood disturbance on no-run days. In contrast, high commitment and high dependence participants displayed the least mood disturbance between run and no-run days.
In another study in which the participants were aware of the length of the
depression period, Mondin and his colleagues (1996) examined the effects of three days
of exercise withdrawal for habitual exercisers. Participants were six males and four
females who exercised 6 to 7 days a week for at least 45 min a day. The participants
customarily engaged in cardiovascular exercise that included jogging, swimming, and
cycling. Measurements included the State Anxiety Inventory, POMS, Depression
Adjective Checklist (Lubin, Hornstra, & Dean, 1978), and a questionnaire that examined
sleep, food intake, and general feelings over the past 24 hours. The study was conducted
on five consecutive days (Monday through Friday) and from Tuesday to Thursday the
participants refrained from their regular exercise routine and also limited their lifestyle
exercise (e.g., take the elevator instead of the stairs, park close to buildings). On Monday
and Friday the participants engaged in their regular exercise routine.

Participants completed the questionnaires at the laboratory on Monday and Friday
within 15-20 minutes following their regular exercise. Tuesday through Thursday the
participants returned to the laboratory and completed the questionnaires at the same time
they were administered on Monday and Friday. The authors found that total mood
disturbance increased on Tuesday, peaked on Wednesday, decreased slightly on
Thursday, and returned to baseline on Friday. It was concluded that exercise deprivation
negatively affected mood, tension, and depression in habitual exercisers.

Prospective Studies

In a prospective study, Szabo and his colleagues (1998) examined runners’
anxiety and mood on running and nonrunning days for 21 consecutive days. Ten female
and 30 male runners were recruited through a local running club. The Commitment to
Running Scale was used to determine the participant’s level of devotion to running. The
State Anxiety Inventory and the Exercise-Induced Feeling Inventory (Gauvin & Rejeski, 1993) were used to examine mood and anxiety. The questionnaires were completed every evening and the participants reported how they felt in the last 24 hours. The subjects also recorded their running distance and time and stated any major life-event stresses that occurred.

It was found that the females indicated greater exhaustion during the nonrunning days than the running days. Also on the nonrunning days, men reported more tranquility than women. Gender-related differences occurred in regards to running speed and commitment to running, with males scoring higher than females. When effect sizes were computed however, only revitalization had a moderate effect for females on running versus nonrunning days. Although these results support better mood on running compared to nonrunning days, the differences were minor.

**Correlational Studies**

The majority of deprivation studies are correlational (e.g., Harris, 1981b; Szabo et al., 1996) and require participants to recall how they felt during nonexercise periods. Therefore, the deprivation period is not manipulated. For example, Szabo and his colleagues (1996) had participants recall why they began exercising and whether they experienced withdrawal effects when they discontinued exercise. Participants were recruited via the Internet through exercise discussion and news groups. In order to be eligible for study participation, an individual had to be age 18 or older, understand English fluently, and engage in physical activity at least twice a week. Five exercise discussion/news groups received a 3-part message every week for 12 weeks. The first message consisted of the purpose of the study and criteria for participation. The second message asked for demographic characteristics and motives for beginning to exercise.
The last message included the following questionnaires: the State-Trait Anxiety Inventory, the Deprivation Sensation Scale (Robbins & Joseph, 1985), and the Commitment to Physical Activity Scale (Corbin, Nielsen, Borsdorf, & Laurie, 1987).

Bowlers represented the control group because their activity requires minimal physical exertion, while participants engaging in aerobic exercise, weight training, cross-training, and fencing represented the experimental group. It was found that participants who started exercising for health reasons reported less trait anxiety and commitment; however, they also felt the most deprivation effects compared to those participants who were active for other reasons.

Finally, Harris (1981b) surveyed 156 females to investigate why they started running and the psychological and behavioral effects of running. The author-developed questionnaire assessed physical changes that occurred due to running, alterations in self-concept, menstrual cycles, and habits such as drinking, smoking, and eating. Participants who stopped running (90% of those surveyed) felt less energetic, fatter, depressed, and tense. Because running was discontinued for various reasons however, no information was provided on the deprivation length or dependence level.

**General Summary**

In a comprehensive review of the exercise-deprivation literature, Szabo (1995) concluded that the majority of studies have found that exercisers report withdrawal effects during exercise-deprivation periods. The studies reviewed varied markedly on the number and age of participants, the mode and amount of exercise, the length of deprivation, and the instruments and methodology used. These inconsistencies among studies make it difficult to understand the effects of exercise deprivation on psychological well-being. It has been shown that exercise deprivation leads to negative feelings, but as
to what degree or what point an individual is likely to experience deprivation sensations is not understood (Szabo, 1998). Withdrawal symptoms may vary from person to person depending on their level of exercise dependence. In other words, it may take different individuals a day versus a week to experience the same withdrawal symptoms. Furthermore, Szabo (1995) commented that recruitment of participants is the greatest limitation for exercise-deprivation studies because exercise-dependents are not likely to participate in such a study. Szabo (1995) also noted that most of the studies have examined runners. Finally, the majority of research has used a single measurement when gathering data on subjective feelings during deprivation. This creates a limitation because one measurement may not portray the feelings of an exercise deprived individual.

In summary, Szabo (1998) brought to the forefront the difficulty of studying exercise deprivation. He stated that the longer the deprivation period, the less likely exercise-dependent participants are willing to partake in these studies. The research design of exercise deprivation should not be limited to experimental designs (Szabo, 1997). Thus, more opportunistic (e.g., taking advantage of situations such as bad weather and not being able to exercise) and descriptive studies (e.g., qualitative research) need to be undertaken. Szabo (1998) concluded that studying exercise-deprivation is not “hopeless”; however, there are confounds to control and different methodologies that must be examined.

**Prior Research Limitations**

Examining the prior literature that exists on exercise-deprivation is critical in order to design functional future studies. The following deprivation literature limitations must be taken into account when designing a study. First, the majority of exercise-
deprivation research has examined runners (Chan & Grossman, 1988; Conboy, 1994; Crossman et al., 1987; Morgan, 1979; Morris et al., 1990; Sachs & Pargman, 1979; Thaxton, 1982). Exercise dependence, however, is not confined to this activity. Limited research has been conducted using various sports and activities such as swimming (Crossman et al., 1987), aerobic exercise, cross-training, and weight lifting (Gauvin & Szabo, 1992; Szabo, Frenkl, & Caputo, 1996).

Second, the measurements and parameters used to define exercise dependence have varied across studies. Inclusion criteria have ranged from participants’ weekly exercise frequency (Baekeland, 1970; Carmack & Martens, 1979), duration of weekly exercise (Gauvin & Szabo, 1992; Thaxton, 1982), mileage per week (Blumenthal et al., 1984; Chan & Grossman, 1988; Harris, 1981a; Robbins & Joseph, 1985; Wittig et al., 1992), and psychological inventories (Conboy, 1994; Estok & Rudy, 1986; Szabo et al., 1998; Thaxton, 1982; Wittig et al., 1992). Third, it is difficult to generalize study findings due to the varying lengths of exercise-deprivation (Baekeland, 1970; Conboy, 1994; Thaxton, 1982). For example, research has shown that 24-hours of exercise-deprivation results in withdrawal symptoms; however, deprivation periods have lasted as long as one month (Baekeland, 1970; Conboy, 1994; Thaxton, 1982).

Fourth, control groups have been either nonexistent or inconsistent. Researchers have failed to use control groups when examining deprivation (Morris et al., 1990; Wittig et al., 1992). In studies where control groups were present, the sample has been inconsistent with the experimental deprivation group. Additionally, recruiting exercise-dependent participants willing to forgo exercise is difficult (Szabo, 1998). There is also concern whether advertising for a deprivation study may confound the results because the
participants can mentally prepare for the time off (Bamber, Cockerill, & Carroll, 2000; Szabo, 1995).

Fifth, there has been a lack of physiological assessments of exercise behavior. This results in an over reliance on self-report measures of exercise behavior. The majority of studies lack physiological measurements because the tests: (a) are time consuming, (b) require expensive equipment to conduct, and (c) require experimenter expertise (Conboy, 1994; Crossman et al., 1987; Mondin et al., 1996; Morris et al., 1990; Szabo, 1996). Physiological measures are deemed more desired than self-reported exercise because they are more accurate (American College of Sports Medicine [ACSM], 2000).

Finally, measures of mood were often assessed by unstandardized assessment tools. This could lead to incorrect measurement and interpretation (Baekeland, 1970; Estok & Rudy, 1986; Gauvin & Szabo, 1992; Wittig et al., 1992). Similarly, instruments to assess exercise dependence were also prone incorrect measurement and interpretation (Hausenblas & Symons Downs, 2001).

**Purpose**

The first purpose of this study was to examine mood states during a 24-hour exercise-deprivation period between individuals who were high and low on exercise dependence symptoms. The second purpose was to examine differences concerning motives to exercise between the high and low exercise-dependent groups. The third purpose was to determine if differences between groups existed in regards to the physiological fitness measurements.
Improving upon previous exercise-deprivation research: (1) a standardized multidimensional measure of exercise dependence was administered to determine the high and low dependence groups; (2) standardized measures were used to assess mood states and exercise; (3) age matched groups were recruited; (4) physiological measures of exercise behavior were conducted; (5) a manipulation check for the deprivation period was undertaken; and (6) participants were screened for eating disorders to control for the confound of primary versus secondary dependence.

**Significance of the Study**

There are several reasons why this study is of significance to the exercise psychology field. First, using standardized and valid measures has eliminated many of the limitations in prior studies. Second, this study examines one of the criteria (i.e., withdrawal) for exercise dependence, when modified in accordance to the DSM-IV. Determining whether deprivation exists and if so, to what extent, will assist in learning whether this is a criterion of exercise dependence. Finally, examining if differences occur in motivation to exercise between low and high exercise-dependent individuals may provide insight to bridging the gap between the two extreme behaviors of exercise.

**Hypothesis**

First, based on previous literature (Szabo, 1995, 1998) it was hypothesized that individuals high in exercise dependence symptoms would report more mood disturbance following a 24-hour exercise-deprivation period compared to the low exercise-dependent group. Specifically, individuals in the high exercise dependence group would indicate a decrease on the Feeling Scale and the Exercise-Induced Feeling Scale, an increase on the State Anxiety Inventory, and an increase on the number of negative affect symptoms
following a 24-hour deprivation period compared to the low exercise dependence group. These results are expected due to the physical and psychological reliance upon exercise of the high exercise dependence group. Additionally, previous research has supported the tendency of exercise-dependent individuals to report an increase in negative mood when exercise deprivation occurs (Baekeland, 1970; Conboy, 1994; Gauvin & Szabo, 1992; Mondin et al., 1996; Morris et al., 1990; Thaxton, 1982; Wittig et al., 1992).

Second, it was hypothesized that more internal and external motivation to exercise would be reported by the high exercise-dependent group versus the low dependent group. In particular, high exercise dependence individuals will score higher on the intrinsic motivation (IM) subscales of the Exercise Motivation Inventory (Li, 1999; i.e., IM to know, IM toward accomplishments, and IM to experience stimulation) compared to the low exercise dependence group. Also the high exercise dependence group will score higher on the Extrinsic Subscales of Introjection and Identification than the low exercise dependence group. Elevated levels of intrinsic motivation and self-determination are likely to be present in individuals with high exercise dependence compared to those with low levels of exercise dependence because of the discipline necessary to exercise habitually. Li (1999) demonstrated higher levels of intrinsic motivation and self-determination in frequent exercisers versus less frequent exercisers.

Third, it was hypothesized that the exercise-dependent group would have a higher \( \text{VO}_2 \) compared to the low exercise dependence group. Also, the high exercise dependence group would have a lower percent body fat than the low exercise-dependent group. Evidence for this hypothesis can be found in the literature on physical activity and physiological adaptations. That is, fit individuals exhibit a higher estimated \( \text{VO}_2 \) due to
increased efficiency of the cardiovascular system and a lower body composition from more muscle tissue versus fat tissue than unfit individuals (ACSM, 2000).
CHAPTER 2
METHOD

Participants
Participants were 42 volunteer female students ($M = 21.18$, $SD = 3.54$) recruited from sport and fitness classes at the University of Florida. Because sex differences exist for mood (APA, 1994), only females were recruited as to not confound the results with gender reporting biases. Also, participants were restricted to the ages of 18 to 25 because of the positive relationship between age and mood disturbance (APA, 1994). Sample size was determined using Potvin’s (1996) power tables for repeated measure designs and was based on an alpha of .05, using an average correlation between repeated measures of .50, and a meaningful effect size of .70. The sample size of 40 (20 in each group) resulted in a power that exceeded .85 for the main effects and .75 for the interaction effects of interest for the analyses conducted.

Instruments
Drive for Thinness Subscale. The Drive for Thinness Subscale is a 7-item subscale from the Eating Disorder Inventory–2 (Garner, 1991) that measures the pursuit of thinness which is the cardinal feature of eating disorders. Statements assessing excessive concern with dieting, preoccupation with weight, and fear of gaining weight are given with a 6-point Likert Scale anchored at the extremes with 1 (never) and 6 (always; see Appendix B). The Drive for Thinness Subscale has demonstrated adequate reliability and validity (Garner, 1991). The reliability in the current study was good (alpha = .79).
**Exercise Dependence Scale.** The Exercise Dependence Scale (Hausenblas & Symons Downs, 2001) is a 30-item scale that assesses exercise dependence symptoms based on the criteria from the DSM-IV diagnosis for substance dependence (APA, 1994). Respondents indicate their agreement to the statements using a 6-point Likert Scale anchored at the extremes with 1 (never) and 6 (always). A high score indicates more exercise dependence symptoms. The scale also discriminates between exercise dependent and nondependent individuals. Questions refer to beliefs and behaviors that have occurred within the last three months (see Appendix C). Examples of items include “I feel anxious if I cannot exercise,” “I organize my life around exercise,” and “I often exercise with more intensity than I intend.” Preliminary research has shown the scale to have adequate reliability and validity (Hausenblas & Symons Downs, 2001).

**Exercise Motivation Scale.** The Exercise Motivation Scale (Li, 1999) is based on the self-determination model and contains eight subscales reflecting three types of motivation: amotivation, external motivation, and internal motivation (See Appendix D). Amotivation represents a lack of motivation whereby individuals do not perceive a connection between their action and the outcome of their action. External motivation is behavior that is a means to an end. There are four types of extrinsic motivation: (a) extrinsic regulation which is behavior controlled by external sources such as material rewards, (b) introjected regulation which represents behavior reinforced through internal pressures from the individual such as guilt, (c) identified regulation which is behavior that is internally motivated and performed out of choice, and (d) integrated regulation which is a fully self-determined form of extrinsic motivation.

Internal motivation represents engaging in a behavior for the pleasure and satisfaction derived from it. There are three types of internal motivation: (a) internal
motivation to learn which is behavior performed to explore and understand, (b) internal motivation to accomplish which is behavior engaged in for the pleasure and satisfaction of accomplishing something, and (c) internal motivation to experience sensations which represents behavior done to experience a stimulating sensation. Thirty-one statements are given in which an answer from strongly disagree (1) to strong agree (6) must be selected. A high score indicates a greater endorsement of motivation. The Exercise Motivation Scale is a valid and reliable measure of exercise motivation (Li, 1999).

**Reasons for Exercise Inventory.** Silberstein, Striegel-Moore, Tinko, and Rodin (1988) developed the Reasons for Exercise Inventory to assess the motives for engaging in exercise. This inventory consists of 24 statements on a 7-point Likert Scale ranging from “not at all important” (1) to “extremely important” (7; see Appendix E). The inventory contains the following seven subscales: Weight Control, Fitness, Mood, Health, Attractiveness, Enjoyment, and Tone. Higher subscale scores indicate a strong motive to exercise. Examples of statements include: “To be slim,” “To improve flexibility, coordination,” “To cope with stress, anxiety,” “To improve my overall health,” “To improve my appearance,” “To have fun,” and “To improve my overall body shape.” Adequate scale reliability and validity have been established (Silberstein et al., 1998).

**Leisure-Time Exercise Questionnaire.** The Leisure-Time Exercise Questionnaire is a three-item scale developed by Godin, Jobin, and Bouillon (1986). Respondents are asked to recall the number of exercise sessions greater than 20 minutes and the intensity of each session undertaken within a typical week. The exercise intensities are mild, moderate, and strenuous (see Appendix F). To determine the metabolic equivalents (METS), the frequency of exercise is multiplied by the activity intensity. Each intensity level is appointed a number that is then multiplied by the frequency. The frequency of mild
exercise is multiplied by three, moderate by five, and strenuous by nine. The values for mild, moderate, and strenuous exercise are added to determine the total exercise index. A high score represents a greater level of activity. This questionnaire has displayed adequate reliability and validity (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Exercise-Induced Feeling Inventory (EFI). The EFI is a 12-item questionnaire developed by Gauvin and Rejeski (1993) that examines feeling states sensitive to acute aerobic exercise. There are four subscales: Positive Engagement, Revitalization, Tranquility, and Physical Exhaustion. A response ranging from “do not feel” (1) to “feel very strongly” (5) is provided by the participants (see Appendix G). Higher subscale scores indicates the most prominent feeling state, while a low score suggests little or no occurrence of a particular feeling state. This inventory has demonstrated adequate psychometric properties (Gauvin & Rejeski, 1993).

Profile of Mood States (POMS). The trait version of the POMS developed by McNair, Lorr, and Droppleman (1971) was used to assess mood. The 65-item questionnaire contains the following six subscales: tension, fatigue, vigor, anger, confusion, and depression (see Appendix H). The participants complete the questionnaire based on “how you are feeling in general.” The scale is anchored at 0 (not at all) to 4 (extremely). The higher a score, the more prominent the corresponding mood state. The POMS has demonstrated adequate reliability and validity (McNair et al., 1971).

Feeling Scale. The Feeling Scale, developed by Hardy and Rejeski (1989), is a single item measure designed to assess current feeling state. Respondents rate their current feeling state by choosing a number on the 11-point bipolar scale anchored at the extremes with –5 (very bad) and 5 (very good; see Appendix I). This scale has demonstrated adequate reliability and validity (Hardy & Rejeski, 1989).
State-Trait Anxiety Inventory (STAI). State anxiety was assessed using Form Y-1 of the STAI which assesses cognitive aspects of state anxiety (Speilberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The 20-item questionnaire asks respondents to indicate on a 4-point scale anchored at the extremes with (1) never to (4) always how they currently feel (see Appendix J). High scores reflect greater state anxiety. Interitem consistency, factor analytic validity, convergent validity, and divergent validity are adequate (Speilberger et al., 1983).

Positive and Negative Affect Schedule (PANAS). The PANAS is a 20-item affective measure that assesses positive and negative affect (Watson, Clark, & Tellegen, 1988). Positive affect (n = 10 items) represents the extent to which a person feels enthusiastic, active, interested, excited, and alert, for example. High positive affect is characterized by high energy, full concentration, and pleasurable engagement; whereas low positive affect includes feelings of sadness and lethargy. Negative affect (n = 10 items) reflects the degree to which individuals feel distressed, upset, guilty, irritable, and nervous, for example. Low negative affect represents a state of calmness or serenity, while high negative affect represents unpleasurable engagement and subjective distress. Participants indicate their endorsement of the affective items on a 5-point Likert scale anchored at the extremes with 1 (very slightly or not at all) and 5 (extremely; see Appendix K). The PANAS has been found to consist of two dominant and relatively independent dimensions that have adequate psychometric properties (Watson et al., 1988).

Body composition. Body composition was assessed using two methods: Body Mass Index (BMI) and skinfold measurements. First, weight was assessed using a Health-O-Meter Scale (Technical Services Inc) in kilograms with a built in measurement stick to
determine height. BMI was determined using height and weight (kg/m\(^2\)) calculations. The BMI method has a standard error of 5% (ACSM, 2000).

Second, skinfold measurements, which are based on the principle that the amount of subcutaneous fat is proportional to the total amount of body fat, were used to estimate body fat percent. Body composition was estimated using the 3-site (triceps, suprailliac, and thigh) skinfold method (Lange Calipers; Cambridge Scientific Industries, Cambridge, MD). The following equation was used based on the three sites to estimate body density:

\[
[1.099421 - (0.0009929 \times \text{sum of body composition}) + (0.0000023 \times \text{sum of body composition}^2) - (0.0001392 \times \text{age})] \quad \text{(Jackson & Pollock, 1985)}.
\]

A population specific formula for white females, age 20-80, was used to convert body density to percent body fat \[((5.03/\text{Body Density}) - 4.59) \times 100\]; Heyward & Stolarczyk, 1996). Using the correct techniques and equations, the skinfold method has demonstrated adequate accuracy (SD = 3.5% body fat; ACSM, 2000).

**Heart rate.** Heart rate was measured using a Polar Favor heart rate monitor (Polar CIC Inc., New York) that was strapped around the participant's chest during physical activity. The ACSM (2000) states that there is a linear relationship between heart rate and VO\(_2\) and that heart rate is a valid method to estimate exercise intensity. Heart rate monitors are an accurate and reliable measure of exercise intensity (ACSM, 2000).

**Rating of Perceived Exertion (RPE).** Rating of perceived exertion was determined by the Borg scale (Borg & Noble, 1974). The Borg scale is an interval scale ranging from 6 (very light) to 20 (maximal exertion) and mimics the amount of exertion the heart is handling (see Appendix L). The larger the number, the higher the heart rate and thus, more exertion is being given to the task. RPE is a reliable measure to indicate exercise
tolerance of individuals (ACSM, 2000) and has demonstrated adequate psychometric properties (Borg & Noble, 1974).

**Maximal Exercise Test.** To estimate oxygen uptake, subjects performed a maximal graded exercise test using the Bruce protocol (see Appendix M). This test measures the cardiorespiratory endurance of an individual. The Bruce Protocol is the most common treadmill procedure and is best suited for younger and active individuals (ACSM, 2000).

An equation to estimate VO$_2$ max that assesses the total amount of time the participant was able to follow the treadmill protocol was used. The following equation calculates VO$_2$ in relative terms, accounting for body weight, so comparisons can be made among the participants: 

$$\text{VO}_2\text{max (ml/kg/min)} = 14.8 - 1.379 \times (\text{time in minutes}) + 0.451 \times (\text{time}^2) - 0.012 \times (\text{time}^3); \text{Foster, et al., 1984}.$$  

This equation has been proven to be reliable and valid (Heyward & Stolarczyk, 1996). The higher the estimated VO$_2$max, the better the cardiorespiratory fitness level.

**Pre-Participation Questionnaire (PPQ).** The PPQ is a self-report measures which identifies medical concerns that would place the participant at increased risk for complications during the exercise test (see Appendix N). Significant medical conditions and the risk factors for heart disease, as determined by the ACSM, are formulated in questions in the PPQ (ACSM, 2000). Participants who indicated “yes” to any question were asked about the condition. If the condition did not put the individuals at risk, in conjunction with not interfering with any of the variables that the test is determining, the subject was allowed to participate in the study.

**24-Hour History.** The 24-hour history questionnaire determines if the participant is physically able to perform the maximal exercise test and that their behavior in the past 24-hours would not interfere with the results (e.g., drinking alcohol or caffeine,
smoking). This questionnaire inquires about sleep, food intake, caffeine and alcohol consumption, and physical activity (see Appendix O). It also asks for a general overall feeling at the present time including: excellent, very good, good, neither good or bad, bad, very bad, or terrible. This questionnaire has been shown to be reliable for following pretest instructions suggested by the ACSM for maximal exercise testing and minimizes the chances of a poor test (ACSM, 2000).

**Manipulation Check.** A manipulation check was undertaken in an attempt to elicit a true response from the participants when questioned about refraining from exercise for the past 24 hours. Two Q-tips with colored tips were placed in labeled baggies for the participant to perform a “swab” test. After the swab test was completed, the Q-tips were placed back into the baggie and sealed with tape. This was a bogus test used in an attempt to determine whether the participants adhered to the deprivation period.

**Procedure**

**Prescreen.** Participants were prescreened using the Drive for Thinness Subscale of the EDI-2 (Garner, 1991) and the Exercise Dependence Scale (Hausenblas & Symons Downs, 2001). The scales were administered to sport and fitness classes. Those students scoring above 14 points on the Drive for Thinness were disqualified from the study because they are deemed at-risk for an eating disorder (Garner, 1991). This was done to prevent a confound in the results by using primary and secondary exercise dependent individuals. Students scoring in the upper and lower 33% on the Exercise Dependence Scale were eligible to participate in the study. These individuals were then phoned and asked if they would be willing to participate in the study. An appointment was made for the first visit and instructions were given to ensure proper readiness for the maximal exercise test to be completed. Participants were told that the first appointment consisted
of a fitness assessment and that they needed to wear shorts, a loose fitting top, and exercise shoes. They were also informed that at least three hours prior to the appointment they should not eat heavily or consume any type of tobacco, alcohol, or caffeine, and to not exercise prior to the fitness test.

Visit 1. On the first visit, the participant was informed of the study procedures and completed the informed consent (see Appendix P) and PPQ. After the PPQ was reviewed by the experimenter, a series of questionnaires (i.e., Exercise Motivation Scale, Reasons for Exercise Inventory, Leisure-Time Exercise Questionnaire, POMS) along with questions pertaining to the participants training schedule were completed. A 24-hour recall was given to the participant to ensure that the directions given over the phone were followed.

A fitness assessment was then administered at Living Well, the faculty and staff fitness center for the university. The assessment included height and weight, body composition measurements (Lange Calipers), as well as the maximal treadmill test. Weight was measured on a Health-O-Meter Scale in kilograms and height was assessed in inches using a built-in measurement stick on the scale. Resting blood pressure and pulse were assessed while the participant was sitting. Blood pressure was measured using a Labtron Graham-Field Patricia 03-180 Series blood pressure cuff. The resting pulse was measured for 30 seconds utilizing the radial artery. Body composition was estimated using the three site measurement of the tricep, suprailiac, and thigh. Skinfolds were taken on the right side of the body at anatomical locations described by the ACSM (2000). Each site was measured three times and the average of each site was recorded. To determine the percent body fat, a population specific formula was used for white females, age 20-80 (ACSM, 2000). Although the ages in the study ranged from 18-25,
this equation was the most appropriate compared to other equations. In order to not confound the results, the participants were asked during the assessment if they currently trained or competed in athletics and any positive responses resulted in dismissal of that participant. None of the participants met the criteria to be dismissed.

A symptom-limited Bruce protocol was used as the maximal exercise test to measure estimated VO$_2$max. Two examiners administered this test according to ACSM guidelines (ACSM, 2000). One examiner was responsible for administering the test, taking blood pressure, and controlling the grade. The other examiner recorded the heart rate and blood pressure, controlled the speed, and recorded rating of perceived exertion measurements. Heart rate was continuously monitored by wearing a heart rate monitor. The starting treadmill speed was set at 1.7 miles per hour with a 10% grade. Every three minutes (one stage) the speed was increased and the grade consistently increased by two percent. At the end of each minute, heart rate was recorded while blood pressure and RPE were obtained and recorded at the end of every stage. RPE was determined by holding a large chart in front of the subject and having them verbally express the number corresponding to how they were feeling. The participant continued the test until volitional fatigue or they requested to stop. Towards the end of the test, the participant was verbally encouraged to continue as long as possible to make certain maximum effort and heart rate were obtained. A cool down was performed to ensure heart rate returned to pretest level by lowering the grade of the treadmill to zero and reducing the speed to a normal walking pace.

The examiners were a graduate student trained in exercise testing according to the ACSM guidelines (ACSM, 2000) and two undergraduate students majoring in exercise
science. The graduate student assumed the role of test administer and the undergraduate students were trained according to ACSM guidelines and assisted in the testing.

**Visit 2.** Upon returning for the second visit, the participants were asked to complete a series of questionnaires assessing mood (i.e., EFI, Feeling Scale, SAI, and PANAS). The participants were then instructed to choose any cardiovascular exercise machine (i.e., Trackmaster TM210 treadmill, Stairmaster 4000PT, Concept II rower, Nordic Track, Precor EFX546 cross trainer, Stairmaster Freerunner 5400ESS, or NuStep TRS3000 recumbent stepper) and exercise for 30 minutes at a specified heart rate. The specified heart rate was determined by using the maximum heart rate obtained during the maximal treadmill test. The heart rate reserve method using the Karvonen formula was utilized to estimate heart rate at 70% of maximum heart rate. This formula is more accurate than using the traditional maximum heart rate formula (220 – age; ACSM, 2000). A maximum heart rate of 70% was used to achieve a level both high and low scorers on the Exercise Dependence Scale could achieve. The low scorers may have struggled to reach 70% while the high scorers would possibly have to refrain from going above 70% of their estimated VO$_2$ max.

The participants were given the same heart rate monitor used during the assessment to wear during their cardiovascular session. The watch displaying the pulse rate was strapped to the equipment so both the participant and the examiner could monitor the heart rate. Heart rate was recorded every 5 minutes throughout the 30 minutes to ensure the proper effort. The participants were allowed to choose their piece of exercise equipment. This created a more ecologically valid assessment and reduced potential anxiety from using either novel or infrequently used equipment (Focht, 2000). When the 30 minutes was concluded, the participants cooled down on the equipment until
heart rate was within their normal resting range. The same questionnaires that were completed at the beginning of the session were readministered. The participants were instructed not to engage in physical activity for the next 24 hours and to limit lifestyle exercise (e.g., walking/biking to campus).

The participants were also told that upon arrival for the next visit a “swab” test would be performed that would determine if they exercised during the past 24 hours. This was a bogus test designed as a manipulation check. It was developed to make the subject believe that the researchers could determine if she adhered to the deprivation period. Participants were instructed to return in 24 hours.

Visit 3 (Follow Up). On the last visit, the participants were instructed to perform the swab test by swiping the inside of each cheek with Q-tips that were colored at one end. The samples were then put into baggies that were labeled with the participant’s subject number. The series of questionnaires that were completed during the second visit (i.e., EFI, PANAS, Feeling Scale, and SAI) were readministered following the swab test. The participant was then told to sit for 30 minutes in a quiet room where reading and homework was allowed. The questionnaires were then redistributed and the order of the questionnaires were counterbalanced to avoid response bias. Upon completion of the questionnaires, the participants were asked to honestly answer whether they performed any physical activity within the previous 24 hours. All participants were given a summary sheet of their fitness assessment results and an e-mail address where they could contact the experimenter to obtain a copy of the study results.

Drop-Outs

Over the course of the study, four participants discontinued with the study. Two of the participants completed the first visit and never returned for the remaining visits.
Despite numerous phone calls. One of the participants who did not return after the first visit was contacted by phone and said she did not have time to finish the study. The last participant who did not finish the study completed the first two visits but had an unexpected event occur and could not attend the last visit unless the deprivation period was extended to 48 hours. In order to not confound the results, this participant was dropped from the study. Of the individuals who discontinued the study, three of the four were high exercise dependent group while only one represented the low exercise dependent group.

**Data Analysis**

Prior to examination of the hypotheses the reliability (i.e., internal consistency) of the measures were undertaken.

**Hypothesis 1**

Statistical analysis for the first purpose included two separate 2 (group) x 4 (time) analysis of variance (ANOVA) on the SAI and Feeling Scale with repeated measures on the time factor. The independent variable was the group (high vs. low dependence) and the dependent variables were the SAI and the Feeling Scale. Effect sizes were computed to determine the meaningfulness of the results (Cohen, 1977).

Given the significant correlations between the EFI and PANAS subscales reported in previous research (Gauvin and Rejeski, 1993), a 2 (group) x 4 (time) multivariate analysis of variance (MANOVA) with repeated measures on the second factor were used to examine group differences for the these scales. Group was the independent variable and the EFI and the PANAS were the dependent variables. Univariate ANOVA with Bonferonni adjustments were employed for follow-up analysis of the significant
multivariate effects. Effect sizes were computed to determine the meaningfulness of the results (Cohen, 1977).

**Hypothesis 2**

For the second purpose of comparing group differences on mood and reasons and motives to exercise, three separate MANOVAs were conducted on the Reasons for Exercise Inventory, Exercise Motivation Scale, and POMS. Follow-up univariate ANOVA was completed to determine the significant multivariate effects. To determine the meaningfulness of the results, effect sizes were computed.

**Hypothesis 3**

For the third purpose, one-way ANOVAs were conducted to determine group differences on the demographic and fitness variables. The independent variable was the group and the dependent variables were age, height, weight, BMI, body composition, cardiovascular endurance, and the Leisure-Time Exercise Questionnaire. Bonferonni adjustments were made when necessary and effect sizes were computed to determine the meaningfulness of the results.

**Assumptions For Statistical Analyses**

Before the analyses were conducted, the data were examined to ensure the appropriate statistical assumptions were met. The ANOVA has four assumptions: 1) scores in each group are independent, 2) data are on a parametric scale, 3) the population is normally distributed, and 4) homogeneity of variance exists (Agresti & Finlay, 1997; Gravetter & Wallnau, 2000). Assumptions 1 and 2 were met because the groups were independent and the data was on either an interval or a ratio scale. To determine if assumption 3 was met (the population was normally distributed) examination of the skewness of the data was undertaken. The homogeneity of variance was checked using
the Box’s M test. In the unlikely chance that the test was less than .05, the largest group variance was examined to ensure the variance was not more than two times the smallest group variance in order to not have an impact on the $F$ value (Vincent, 1995).

Assumptions for the MANOVA include: 1) random sampling and independent scores, 2) normal distribution in each group, 3) homogeneity of covariance matrices, and 4) the relationship for the dependent variables are linear. Random sampling is a design issue and is not violated in this study. To determine normal distribution, univariate normality was assessed. If normality was not met, the MANOVA is robust to moderate violations as long as the violation is created by skewness. The assumption of homoscedasticity is violated by nonnormality of one of the variables or one variable may have a relationship to the transformation of another variable. Box’s M is the statistical test that is commonly used to check for violations of homoscedasticity. However, if the test is significant, it will not prove fatal to the analysis. Although unlikely, if homoscedasticity is violated, Pillai’s Trace will be used to interpret multivariate results. If homoscedasticity is not violated, Wilks’ Lambda will be used to interpret the results. To determine linearity, bivariate scatterplots will be completed with an elliptical shape indicating the presence of normality (Vincent, 1995).

Repeated measures ANOVA also has four assumptions: 1) observations are independent, 2) the population distribution is normal, 3) equivalent covariances, and 4) homogeneity of variance. The first and second assumptions are experimental design errors and have not been violated. Examining skewness will assess the variance distribution. The fourth assumption is violated if the effect of the treatment is not consistent for all the participants. If homogeneity of variance is violated the Mauchly’s
Test of Sphericity will be significant and the Greenhouse Geisser adjustment will be used to adjust the degrees of freedom to obtain a more accurate $F$ statistic (Potvin, 1996).

Assumptions for repeated measures MANOVA include: 1) random sampling and independent scores, 2) normal distribution in each group, 3) homogeneity of variance-covariance, and 4) no outliers exist in the data set. The first two assumptions are design issues and have not been violated. The steps taken when a violation of an assumption occurs are identical for a MANOVA.
CHAPTER 3
RESULTS

Manipulation Check

A manipulation check was undertaken to determine if the participants adhered to the instruction of not exercising for 24 hours. On the final visit participants were asked to respond either yes or no to the following self-report question: “Have you exercised in the last 24 hours”? No participants indicated that they had exercised in the previous 24 hours. Thus, it was assumed that the subjects adhered to the deprivation protocol based on their positive response to the “swab test” and their indication that they had not exercised in the past 24 hours.

Reliability of Measures

Internal consistency scores (i.e., Chronbach’s alpha) were determined for each measure prior to examining the study purposes (Nunnally, 1978). Because the alpha value is inflated as the number of variables increases, there is no set interpretation as to what is an acceptable value (George & Mallery, 2001). The general rule of thumb for reliability interpretations displayed in Table 3.1 was used to interpret the alpha levels of the study measures (George & Mallery, 2001).

The Exercise-Induced Feeling Inventory Subscales had acceptable to excellent reliabilities (range = .73 to .93) for all administrations (see Table 3.2). The State Anxiety Inventory evidenced excellent reliabilities for the four assessments (range = .91 to .94).
Table 3.1  
Rule of Thumb for Reliability of Measurements Interpretation

<table>
<thead>
<tr>
<th>Alpha Value</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; .9</td>
<td>Excellent</td>
</tr>
<tr>
<td>&gt; .8</td>
<td>Good</td>
</tr>
<tr>
<td>&gt; .7</td>
<td>Acceptable</td>
</tr>
<tr>
<td>&gt; .6</td>
<td>Questionable</td>
</tr>
<tr>
<td>&gt; .5</td>
<td>Poor</td>
</tr>
<tr>
<td>&lt; .5</td>
<td>Unacceptable</td>
</tr>
</tbody>
</table>

The reliability scores for the Exercise Motivation Scale Subscales were acceptable to excellent ranging from .77 to .93 (see Table 3.7). The Reasons for Exercise Inventory Subscales displayed acceptable to good reliabilities ranging from .69 to .89 (see Table 3.8). The internal consistency scores for the Profile of Mood States (POMS) Subscales were also adequate with a range of .75 to .92 (see Table 3.9).

Table 3.2  
Internal Consistency Scores for the Exercise-Induced Feeling Inventory Subscales, Positive and Negative Affect Scale (PANAS), and the State Anxiety Inventory

<table>
<thead>
<tr>
<th></th>
<th>Exercise N = 42</th>
<th>Rest N = 42</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre Post</td>
<td>Pre Post</td>
</tr>
<tr>
<td>Exercise-Induced Feeling Inventory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Engagement</td>
<td>.86 .87</td>
<td>.87 .86</td>
</tr>
<tr>
<td>Revitalization</td>
<td>.81 .79</td>
<td>.93 .87</td>
</tr>
<tr>
<td>Tranquility</td>
<td>.90 .73</td>
<td>.86 .91</td>
</tr>
<tr>
<td>Physical Exhaustion</td>
<td>.85 .75</td>
<td>.91 .89</td>
</tr>
<tr>
<td>PANAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Affect</td>
<td>.89 .91</td>
<td>.94 .92</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>.86 .37</td>
<td>.70 .84</td>
</tr>
<tr>
<td>State Anxiety Inventory</td>
<td>.93 .91</td>
<td>.92 .94</td>
</tr>
</tbody>
</table>
Finally, the Positive Affect Subscale of the PANAS had excellent internal consistency across all assessments (range = .89 to .94; see Table 3.2). Similarly, the Negative Affect Subscale of the PANAS had acceptable internal consistencies scores for the pre-exercise (alpha = .86), pre-rest (alpha = .70), and post-rest assessments (alpha = .84). In contrast, the post-exercise Negative Affect Subscale was inadequate (alpha = .37). A factor analysis was attempted to determine if the negative affect subscale factor structure was related to the inadequate internal consistency. Due to the lack of item variance (see Table 3.3), however, a factor analysis was unable to be performed. Thus, the Negative Affect Subscale of the PANAS was eliminated from further analyses. Implications of the low reliability of the Negative Affect Subscale will be discussed in the next chapter.

Table 3.3
Mean (M) and Standard Deviation (SD) Scores for the Negative Affect Subscale of the Positive and Negative Affect Schedule (PANAS) for the Post-Exercise Assessment of the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low ED ( n = 20 )</th>
<th>High ED ( n = 21 )</th>
<th>Total ( N = 41 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Upset</td>
<td>1.20</td>
<td>.70</td>
<td>1.29</td>
</tr>
<tr>
<td>Scared</td>
<td>1.00</td>
<td>.00</td>
<td>1.14</td>
</tr>
<tr>
<td>Ashamed</td>
<td>1.20</td>
<td>.52</td>
<td>1.14</td>
</tr>
<tr>
<td>Distressed</td>
<td>1.50</td>
<td>1.15</td>
<td>1.71</td>
</tr>
<tr>
<td>Hostile</td>
<td>1.05</td>
<td>.22</td>
<td>1.14</td>
</tr>
<tr>
<td>Irritable</td>
<td>1.25</td>
<td>.55</td>
<td>1.57</td>
</tr>
<tr>
<td>Jittery</td>
<td>1.35</td>
<td>.99</td>
<td>1.62</td>
</tr>
<tr>
<td>Afraid</td>
<td>.95</td>
<td>.22</td>
<td>1.14</td>
</tr>
<tr>
<td>Guilty</td>
<td>1.10</td>
<td>.31</td>
<td>1.24</td>
</tr>
<tr>
<td>Nervous</td>
<td>1.30</td>
<td>.92</td>
<td>1.38</td>
</tr>
</tbody>
</table>

Note. 1= feeling very slightly or not at all, 5 = feeling very strongly.
Missing Data

Each participant was required to complete several self-report questionnaires that represented 358 data points per person. Seven items from the entire data set were missing, which represented 1.96% of the total item responses. Because of the small percentage of missing data, mean replacements were computed for the missing variables (George & Mallery, 2001).

Eating Disorder Screening

In order to distinguish primary from secondary exercise dependence the Drive for Thinness Subscale of the Eating Disorder Inventory–2 was administered. No participants who completed the Drive for Thinness Subscale evidenced scores in the pathological range of 14 or greater (Garner, 1991). Furthermore, a one-way ANOVA demonstrated no significant group differences on the Drive for Thinness Subscale between the high (M = 5.35, SD = 4.74) and low (M = 8.47, SD = 4.53) exercise dependent groups \[ F(1, 36) = 3.11, p = .09 \].

Primary Hypothesis

The primary purpose of the study was to determine if group differences existed for mood states following 24 hours of exercise deprivation. First, to examine if baseline group differences existed on the pre-exercise assessment of Exercise-Induced Feeling states a one-way ANOVA was conducted. No significant group differences on the Positive Engagement \[ F(1, 39) = .12, p = .73 \], Revitalization \[ F(1, 39) = .03, p = .87 \], Tranquility \[ F(1, 39) = .13, p = .72 \], and Physical Exhaustion \[ F(1, 39) = 1.91, p = .17 \] Subscales were found. Because there were no baseline group differences, these values were not covaried in subsequent analyses. Second, the Mauchly’s Test of Sphericity was
conducted to examine if the assumption of variance was violated. The test determined
the assumption was not met and therefore, the Greenhouse-Geisser adjustments were
needed. Third, a MANOVA with repeated measures on time (i.e., pre and post exercise,
pre and post quiet rest) was computed on the Exercise-Induced Feeling Inventory
Subscales. Significant main effects for time on the Physical Exhaustion \( [F (4, 36) = 2.95,\ p = .05, \ \omega^2 = .07] \), Positive Engagement \( [F (4, 36) = 15.99, \ p < .001, \ \omega^2 = .29] \),
Revitalization \( [F (4, 36) = 24.91, \ p < .001, \ \Sigma = .39] \), and Tranquility \( [F (4, 36) = 9.54, \ p < .001, \ \Sigma = .20] \) Subscales were evidenced. There was no significant main effect for group
\( [F (4, 36) = .69, \ p = .59, \ \Sigma = .07] \) or interaction \( [F (4, 36) = 1.05, \ p = .40, \ \Sigma = .36] \)
evidenced.

To determine where the significance difference occurred for time, post hoc
analysis was performed using the Bonferonni test. Participants reported significantly less
Physical Exhaustion following exercise compared to the pre-exercise and quiet rest
assessments. Positive Engagement and Revitalization were highest after the exercise
session compared to before exercise and before and after the rest period. Finally,
participants reported the most tranquility following quiet rest than before or after exercise
and before quiet rest \( (p < .05) \).

To assess changes in mood an ANOVA with repeated measures on time was
undertaken for the Feeling Scale and the State Anxiety Inventory. Mean and standard
deviation scores for these measures are presented in Table 3.5. First, one-way ANOVAs
were undertaken to determine if baseline group differences existed on the Feeling Scale
and State Anxiety Inventory. Results revealed that there were no group differences on
the baseline assessment of the Feeling Scale \( [F (1, 39) = .004, \ p = .95] \) and the State
Anxiety Inventory \( [F (1, 39) = .01, \ p = .92] \).
Table 3.4
Mean (M) and Standard Deviation (SD) Scores for the Exercise-Induced Feeling Inventory Subscales Across the Assessment Periods for the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th></th>
<th>Positive Engagement</th>
<th>Revitalization</th>
<th>Tranquility</th>
<th>Physical Exhaustion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Low ED (n = 20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.50</td>
<td>3.14</td>
<td>5.05</td>
<td>2.56</td>
</tr>
<tr>
<td>Post</td>
<td>8.11</td>
<td>3.03</td>
<td>8.20</td>
<td>2.71</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.89</td>
<td>3.35</td>
<td>6.11</td>
<td>3.60</td>
</tr>
<tr>
<td>Post</td>
<td>7.11</td>
<td>3.73</td>
<td>5.68</td>
<td>3.76</td>
</tr>
<tr>
<td>High ED (n = 21)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.81</td>
<td>2.62</td>
<td>5.19</td>
<td>2.75</td>
</tr>
<tr>
<td>Post</td>
<td>9.10</td>
<td>2.17</td>
<td>9.14</td>
<td>2.22</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.45</td>
<td>2.21</td>
<td>5.57</td>
<td>2.96</td>
</tr>
<tr>
<td>Post</td>
<td>6.33</td>
<td>2.15</td>
<td>5.10</td>
<td>2.49</td>
</tr>
<tr>
<td>Total (N = 41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.66</td>
<td>2.85</td>
<td>5.12</td>
<td>2.63</td>
</tr>
<tr>
<td>Post</td>
<td>8.63</td>
<td>2.63</td>
<td>8.68</td>
<td>2.48</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>6.67</td>
<td>2.79</td>
<td>5.82</td>
<td>3.25</td>
</tr>
<tr>
<td>Post</td>
<td>6.70</td>
<td>2.99</td>
<td>5.38</td>
<td>3.13</td>
</tr>
</tbody>
</table>

Note. A high score indicates prominent feelings while lower scores demonstrate little or no occurrence of the feeling.

The Feeling Scale was then assessed for the assumption of sphericity using Mauchly’s Test. It was found that homogeneity of variance was present \( \chi^2 (5) = 10.35, p = .07 \). Although a repeated measures ANOVA indicated no significant main effect for group \( F (1, 3) = 12.98, p < .001, \Sigma = .51 \) and interaction \( F (1, 3) = 1.27, p = .29, \Sigma = .03 \), a significant main effect for time \( F (1, 3) = 11.50, p < .001, \Sigma = .23 \) was found.

Tukey’s post hoc test revealed that more positive feelings were reported after the exercise session than before the exercise session or before and after the rest session (\( p \)'s < .05).
For the State Anxiety Inventory, Mauchly’s Test of Sphericity revealed a lack of homogeneity of variance [$\chi^2(5) = 14.68, p = .01$]. Because the assumption of sphericity was not met the Greenhouse-Geisser method was used to adjust the degrees of freedom for an accurate $F$-test statistic. Analysis revealed no significant main effect for time [$F(1, 2.39) = 2.16, p = .11, \Sigma = .05$], main effect for group [$F(1, 2.39) = .45, p = .67, \Sigma = .16$], or interaction [$F(1, 2.39) = .45, p = .67, \Sigma = .01$].

Table 3.5
Mean (M) and Standard Deviation (SD) Scores for the Feeling Scale and the State Anxiety Inventory for the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th></th>
<th>Feeling Scale</th>
<th>State Anxiety Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Low ED (n = 20)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.55</td>
<td>2.06</td>
</tr>
<tr>
<td>Post</td>
<td>3.60</td>
<td>1.54</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.84</td>
<td>1.54</td>
</tr>
<tr>
<td>Post</td>
<td>2.84</td>
<td>1.80</td>
</tr>
<tr>
<td><strong>High ED (n = 21)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.33</td>
<td>1.43</td>
</tr>
<tr>
<td>Post</td>
<td>3.57</td>
<td>1.40</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.05</td>
<td>1.60</td>
</tr>
<tr>
<td>Post</td>
<td>2.62</td>
<td>0.92</td>
</tr>
<tr>
<td><strong>Total (N = 41)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.44</td>
<td>1.75</td>
</tr>
<tr>
<td>Post</td>
<td>3.59</td>
<td>1.45</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>2.43</td>
<td>1.60</td>
</tr>
<tr>
<td>Post</td>
<td>2.72</td>
<td>1.40</td>
</tr>
</tbody>
</table>

Note. The Feeling Scale ranges from –5 (very bad) to 5 (very good). For the State Anxiety Inventory a higher score indicates more anxiety.
Table 3.6
Mean (M) and Standard Deviation (SD) Scores for the Negative and Positive Affect Subscales of the PANAS for the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th></th>
<th>Positive Affect</th>
<th>Negative Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td><strong>Low ED (n = 20)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>29.70</td>
<td>7.51</td>
</tr>
<tr>
<td>Post</td>
<td>34.42</td>
<td>8.27</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>28.45</td>
<td>10.04</td>
</tr>
<tr>
<td>Post</td>
<td>25.95</td>
<td>10.78</td>
</tr>
<tr>
<td><strong>High ED (n = 21)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>29.86</td>
<td>7.30</td>
</tr>
<tr>
<td>Post</td>
<td>34.80</td>
<td>6.57</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>26.48</td>
<td>8.34</td>
</tr>
<tr>
<td>Post</td>
<td>25.29</td>
<td>6.96</td>
</tr>
<tr>
<td><strong>Total (N = 41)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>29.78</td>
<td>7.31</td>
</tr>
<tr>
<td>Post</td>
<td>34.62</td>
<td>7.35</td>
</tr>
<tr>
<td>Rest Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>27.44</td>
<td>9.15</td>
</tr>
<tr>
<td>Post</td>
<td>25.61</td>
<td>8.92</td>
</tr>
</tbody>
</table>

**Secondary Hypothesis**

The secondary purpose was to compare reasons and motives to exercise and mood states between the high and low exercise dependence groups. The Exercise Motivation Scale, Reasons for Exercise Inventory, and POMS was analyzed using a MANOVA to determine if group differences existed. For the Exercise Motivation Scale, the MANOVA revealed significant group differences \[ \text{Wilks' Lambda} = .50, F(1, 35) = 4.39, p = .001 \]. The univariate ANOVA indicated that the high exercise dependence group scored significantly higher than the low exercise dependent group for Introjected
Regulation \([F (1, 42) = 9.90, p = .003, \Sigma = .20]\), Identified Regulation \([F (1, 42) = 18.22, p < .001, \Sigma = .30]\), Integrated Regulation \([F (1, 42) = 24.91, p < .001, \Sigma = .37]\), Internal Motivation to Learn \([F (1, 42) = 9.04, p = .004, \Sigma = .18]\), Internal Motivation to Accomplish \([F (1, 42) = 26.37, p < .001, \Sigma = .39]\), and Internal Motivation to Experience Sensation Subscales \([F (1, 42) = 30.64, p < .001, \Sigma = .42]\) (see Table 3.6 for the mean and standard deviation scores). There were no group differences for the Amotivation \([F (1, 42) = 1.64, p = .21, \Sigma = .04]\) or External Regulation Subscales \([F (1, 42) = .25, p = .62, \Sigma = .01]\).

Table 3.7
Mean (M), Standard Deviation (SD), and Alpha Level Scores for the Exercise Motivation Scale for the High and Low Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low ED</th>
<th></th>
<th>High ED</th>
<th></th>
<th>Total</th>
<th></th>
<th>Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 20)</td>
<td>(n = 21)</td>
<td>(n = 41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amotivation</td>
<td>M = 4.60, SD = 2.09</td>
<td>M = 3.83, SD = 1.88</td>
<td>M = 4.16, SD = 1.98</td>
<td>.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Regulation</td>
<td>M = 8.85, SD = 4.49</td>
<td>M = 8.21, SD = 3.99</td>
<td>M = 4.18, SD = 1.99</td>
<td>.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>M = 11.70, SD = 4.03</td>
<td>M = 15.50, SD = 3.96</td>
<td>M = 13.77, SD = 4.38</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>M = 19.35, SD = 2.66</td>
<td>M = 22.33, SD = 1.97</td>
<td>M = 20.98, SD = 2.73</td>
<td>.78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated Regulation</td>
<td>M = 15.10, SD = 3.85</td>
<td>M = 20.08, SD = 2.75</td>
<td>M = 17.82, SD = 4.11</td>
<td>.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM to Learn</td>
<td>M = 13.50, SD = 4.17</td>
<td>M = 17.04, SD = 3.64</td>
<td>M = 15.43, SD = 4.24</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM to Accomplish</td>
<td>M = 15.85, SD = 3.45</td>
<td>M = 20.54, SD = 2.60</td>
<td>M = 18.41, SD = 3.81</td>
<td>.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IM to Experience Sensation</td>
<td>M = 15.50, SD = 4.38</td>
<td>M = 21.46, SD = 2.69</td>
<td>M = 18.75, SD = 4.62</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. IM = Internal Motivation

A MANOVA examining the Reasons for Exercise Inventory revealed significant group differences \([\text{Wilks’ Lambda} = .57, F (1, 37) = 3.99, p = .002, \Sigma = .43]\). Follow-up univariate ANOVA demonstrated that the high exercise dependent group scored
significantly higher than the low exercise dependent group for Weight Control \( F(1, 43) = 4.78, p = .03, \Sigma = .10 \), Mood \( F(1, 43) = 13.59, p = .001, \Sigma = .24 \), Attractive \( F(1, 43) = 14.07, p = .001, \Sigma = .25 \), Enjoyment \( F(1, 43) = 4.78, p < .01, \Sigma = .25 \), and Tone Subscales \( F(1, 43) = 6.10, p = .02, \Sigma = .12 \) (see Table 3.8 for mean and standard deviation scores). Group differences were not found for the Fitness \( F(1, 43) = 2.16, p = .15, \Sigma = .05 \) and Health Subscales \( F(1, 43) = 2.05, p = .16, \Sigma = .05 \).

Table 3.8
Mean (M), Standard Deviation (SD), and Alpha Level Scores for the Reasons for Exercise Inventory for the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low ED ( n = 21 )</th>
<th>High ED ( n = 24 )</th>
<th>Total ( N = 45 )</th>
<th>Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Control</td>
<td>13.57 4.69</td>
<td>16.13 3.08</td>
<td>14.93 4.08</td>
<td>.69</td>
</tr>
<tr>
<td>Fitness</td>
<td>22.76 3.49</td>
<td>24.29 3.47</td>
<td>23.58 3.53</td>
<td>.83</td>
</tr>
<tr>
<td>Mood</td>
<td>15.14 6.13</td>
<td>20.79 4.05</td>
<td>18.16 5.82</td>
<td>.85</td>
</tr>
<tr>
<td>Health</td>
<td>22.76 5.00</td>
<td>24.54 3.26</td>
<td>23.71 4.21</td>
<td>.89</td>
</tr>
<tr>
<td>Attractive</td>
<td>12.10 4.85</td>
<td>16.58 3.09</td>
<td>14.49 4.56</td>
<td>.88</td>
</tr>
<tr>
<td>Enjoyment</td>
<td>8.81 3.54</td>
<td>13.13 4.04</td>
<td>11.11 4.35</td>
<td>.83</td>
</tr>
<tr>
<td>Tone</td>
<td>13.05 5.13</td>
<td>16.33 3.76</td>
<td>14.80 4.70</td>
<td>.83</td>
</tr>
</tbody>
</table>

Note. A high score indicates an important reason to exercise.

Finally, a MANOVA was performed for the POMS subscales and results indicated no mood differences between the groups [Wilks’ Lambda = .79, \( F(1, 37) = 1.60, p = .18, \Sigma = .17 \)]. When examining the mean scores, however, the high exercise dependent group reported more feelings of depression, anger, confusion, tension, and fatigue compared to the low group (see Table 3.8). In contrast, the low exercise dependent group reported more vigor than the high exercise dependent group.
Table 3.9
Mean (M), Standard Deviation (SD), and Alpha Level Scores for the Profile of Mood States (POMS) Subscales for the High and Low Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Low ED n = 20</th>
<th>High ED n = 21</th>
<th>Total N = 41</th>
<th>Alpha Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>M = 6.00</td>
<td>M = 8.13</td>
<td>M = 7.11</td>
<td>.91</td>
</tr>
<tr>
<td></td>
<td>SD = 5.71</td>
<td>SD = 8.53</td>
<td>SD = 7.32</td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>M = 4.14</td>
<td>M = 6.30</td>
<td>M = 5.27</td>
<td>.92</td>
</tr>
<tr>
<td></td>
<td>SD = 4.23</td>
<td>SD = 7.36</td>
<td>SD = 6.10</td>
<td></td>
</tr>
<tr>
<td>Vigor</td>
<td>M = 13.76</td>
<td>M = 12.00</td>
<td>M = 12.84</td>
<td>.86</td>
</tr>
<tr>
<td></td>
<td>SD = 6.21</td>
<td>SD = 5.95</td>
<td>SD = 6.07</td>
<td></td>
</tr>
<tr>
<td>Confusion</td>
<td>M = 6.00</td>
<td>M = 7.17</td>
<td>M = 6.61</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>SD = 3.52</td>
<td>SD = 4.54</td>
<td>SD = 4.08</td>
<td></td>
</tr>
<tr>
<td>Tension</td>
<td>M = 5.81</td>
<td>M = 9.17</td>
<td>M = 7.57</td>
<td>.84</td>
</tr>
<tr>
<td></td>
<td>SD = 4.11</td>
<td>SD = 5.19</td>
<td>SD = 4.95</td>
<td></td>
</tr>
<tr>
<td>Fatigue</td>
<td>M = 6.14</td>
<td>M = 7.70</td>
<td>M = 6.95</td>
<td>.83</td>
</tr>
<tr>
<td></td>
<td>SD = 3.62</td>
<td>SD = 5.79</td>
<td>SD = 4.88</td>
<td></td>
</tr>
<tr>
<td>POMS total</td>
<td>M = 41.86</td>
<td>M = 50.48</td>
<td>M = 46.36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD = 21.46</td>
<td>SD = 30.92</td>
<td>SD = 26.88</td>
<td></td>
</tr>
</tbody>
</table>

Note. A lower score indicates less prominent feelings.

Third Hypothesis

The final purpose was to determine if group differences existed on the physiological and psychological demographic characteristics. One-way ANOVA’s were conducted for age, height, weight, BMI, percent body fat, cardiovascular endurance, Exercise Dependence Scale, and Leisure-Time Exercise Questionnaire scores. No significant differences were found for age \([F (1, 45) = 3.75, p = .06, \Sigma = .08]\), weight \([F (1, 45) = 3.19, p = .08, \Sigma = .07]\), height \([F (1, 45) = 50, \Sigma = .01]\), and BMI \([F (1, 45) = 2.9, p = .10, \Sigma = .06]\) (see Table 3.10 for mean and standard deviation scores). In contrast, significant group differences were evidenced for percent body fat \([F (1, 45) = 5.77, p = .02, w^2 = .12]\) and cardiovascular endurance \([F (1, 45) = 13.18, p = .001, \Sigma = .24]\) with the high exercise dependent group having less body fat and a higher level of cardiovascular endurance compared to the low exercise dependent group. Significant differences \([F (1, 45) = 284.91, p < .001, \Sigma = .87]\) occurred between the high and low groups on the Exercise Dependence Scale with the high group displaying a higher score.
Table 3.10  
Mean (M) and Standard Deviation (SD) Scores for the Low and High Exercise Dependent (ED) Groups on Physiological Data

<table>
<thead>
<tr>
<th></th>
<th>Low ED (n = 21)</th>
<th>High ED (n = 24)</th>
<th>Total (N = 45)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Exercise Dependence Scale</td>
<td>38.33</td>
<td>8.14</td>
<td>115.54</td>
</tr>
<tr>
<td>Age</td>
<td>22.24</td>
<td>3.88</td>
<td>20.25</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.54</td>
<td>.04</td>
<td>1.53</td>
</tr>
<tr>
<td>Weight (kgs)</td>
<td>66.30</td>
<td>15.02</td>
<td>59.96</td>
</tr>
<tr>
<td>BMI</td>
<td>25.68</td>
<td>5.87</td>
<td>23.45</td>
</tr>
<tr>
<td>Percent Body Fat</td>
<td>23.72</td>
<td>7.36</td>
<td>19.65</td>
</tr>
<tr>
<td>Cardiovascular Endurance</td>
<td>30.07</td>
<td>5.74</td>
<td>36.38</td>
</tr>
</tbody>
</table>

To assess group differences for the Leisure-Time Exercise Questionnaire, a one-way ANOVA was performed for mild, moderate, strenuous, and total exercise. It was found that the high exercise dependent group scored significantly higher than the low exercise dependent group on the mild [F (1, 43) = 4.17, p = .05, Σ = .17], moderate [F (1, 43) = 4.70, p = .04, Σ = .09], strenuous [F (1, 43) = 44.06, p < .001, Σ = .52], and total Leisure-Time Exercise Questionnaire scores [F (1, 43) = 31.94, p < .001, Σ = .45] (see Table 3.11).

Table 3.11  
Mean (M) and Standard Deviations (SD) Scores for the Leisure-Time Exercise Questionnaire for the Low and High Exercise Dependent (ED) Groups

<table>
<thead>
<tr>
<th></th>
<th>Low ED n = 21</th>
<th>High ED n = 24</th>
<th>Total N = 45</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Mild</td>
<td>7.05</td>
<td>6.25</td>
<td>11.50</td>
</tr>
<tr>
<td>Moderate</td>
<td>10.75</td>
<td>10.67</td>
<td>17.92</td>
</tr>
<tr>
<td>Strenuous</td>
<td>12.15</td>
<td>14.39</td>
<td>37.31</td>
</tr>
<tr>
<td>Total</td>
<td>29.95</td>
<td>18.87</td>
<td>66.73</td>
</tr>
</tbody>
</table>

Note. A larger score represents a higher level of physical activity.
Although not a specific hypothesis, examining the concurrent validity of the exercise measure (Leisure-Time Exercise Questionnaire) in relation to the maximal exercise test results was undertaken (see Table 3.12). The correlation revealed that Total Leisure-Time Exercise was significantly related to the subcomponents including mild, moderate, and strenuous exercise. Similarly, cardiovascular endurance was correlated with strenuous and total leisure-time exercise. The correlation between cardiovascular exercise and reported leisure-time exercise was highest for strenuous exercise which is understandable. Thus, self-reported strenuous exercise was linearly associated with a higher cardiovascular endurance level.

Table 3.12
Pearson Correlations for Cardiovascular Endurance and the Leisure-Time Exercise Questionnaire (LTEQ)

<table>
<thead>
<tr>
<th></th>
<th>Cardiovascular Endurance</th>
<th>Mild</th>
<th>Moderate</th>
<th>Strenuous</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular end</td>
<td>1.0</td>
<td>.21</td>
<td>.21</td>
<td>.46*</td>
<td>.42*</td>
</tr>
<tr>
<td>LTEQ Mild</td>
<td>1.0</td>
<td>.47*</td>
<td>.29</td>
<td>.60*</td>
<td></td>
</tr>
<tr>
<td>LTEQ Moderate</td>
<td>1.0</td>
<td>.42*</td>
<td>.78*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTEQ Strenuous</td>
<td>1.0</td>
<td>.85*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = p < .01 (2-tailed).
Researchers have consistently found that regular physical activity contributes positively to physical and psychological health (USDHHS, 1996, 2000). For example, physical inactivity is directly linked to increased morbidity and mortality for at least six chronic conditions: coronary heart disease, hypertension, obesity, diabetes, osteoporosis, and mental health disorders (USDHHS, 2000). Furthermore, a lack of regular exercise is estimated to contribute to 250,000 deaths per year in the United States (Pate et al., 1995).

Despite the health benefits of exercise, facilitating physical activity adoption and adherence remains a challenge because approximately 40% of American adults are sedentary (USDHHS, 2000) and 50% of sedentary adults beginning an exercise program will dropout within 6 months (Dishman, 1994).

Despite the epidemic of sedentariness in North America there are a very small number of individuals who exercise excessively. Exercise dependence is defined as a craving for exercise that results in uncontrollable excessive physical activity and manifests in physiological symptoms, psychological symptoms, or both (Hausenblas & Symons Downs, 2001). It has been suggested that a cardinal symptom or criterion of exercise dependence is withdrawal or deprivation effects (Szabo, 1995). Withdrawal symptoms are manifested by either the characteristic withdrawal symptoms for exercise (e.g., anxiety, irritability) or the same amount of exercise is engaged in to relieve or avoid withdrawal symptoms (APA, 1994). The general purpose of this thesis was to examine the psychological effects of withdrawal in high and low exercise dependent individuals.
This chapter discusses the findings for the first, second, and third purposes as well as outlines the study limitations and future research directions.

**First Purpose**

The first purpose of this study was to examine mood states during a 24-hour exercise deprivation period between individuals who were high and low on exercise dependence symptoms. It was hypothesized that the high exercise dependent group, compared to the low exercise dependent group, would report more negative affect, an increase in state anxiety, and a decrease in positive feeling states after 24-hours of exercise deprivation. Contrary to the hypothesis, there were no differences between the high and low exercise dependence groups on the mood measures following the deprivation period.

The lack of group difference in mood between the groups may be due to the sensitivity of the mood instruments, the length of the deprivation period, or the prescribed exercise intensity. First, although 24-hours has been reported to elicit withdrawal symptoms (Conboy, 1994; Modin et al., 1996), a longer time period may be required in certain populations to elicit deprivation effects. Second, exercise intensity before the 24-hour deprivation period was prescribed at 70% of the estimated VO$_2$ max. It is plausible that the high exercise dependent group was exercising at a lower intensity than normal; and the low exercise dependence group was exercising at a higher intensity than normal. Thus, self-selected exercise intensities, which elicit a more ecologically valid environment, may be more likely to produce withdrawal effects (Focht, 2000). Future research is need to examine withdrawal effects with self-selected versus prescribed exercise intensities.
Third, consistent with past researchers, it was found that the PANAS was not sensitive to mood changes during an acute bout of exercise and quiet rest (Gauvin, Rejeski, Norris, & Lutes, 1997; Nemanick & Munz, 1994; Rejeski, Gauvin, Hobson, & Norris, 1995). That is, participants reported high positive affect and low negative affect at all the assessments which created either a ceiling or floor effect. Furthermore, the Negative Affect Subscale of the PANAS had inadequate internal consistency and was dropped from further analysis. To explore the potential “cause” of the poor alpha value, inter-item consistency, mean, and standard deviation values of each item were examined. A factor analysis was also attempted to determine if the factor structure of the Negative Affect Subscale was indeed unidimensional as proposed by Watson, Clark, and Tellegen (1988). However, because of the lack of variance within each item of the subscale, a factor analysis could not be performed (Tabachnick & Fidell, 2001).

Other researchers have had similar “problems” with the PANAS (Diener & Emmons, 1985; Egloff, 1998; Killgore, 2000). For example, Diener and Emmons (1985) found that affect differed greatly depending on the time frame the questionnaire was answered (e.g., same day or a week later) and concluded that positive and negative affect were independent of each other rather than closely correlated. Similarly, Egloff (1998) found the PANAS to contain two independent subscales while Killgore (2000) discovered a more appropriate model by splitting the negative affect into two factors. Thus, the current results coupled with prior researchers’ findings, questions the utility of the PANAS in assessing affect in repeated measures designs.
Second Purpose

The second purpose was to examine differences concerning motives to exercise between the high and low exercise dependent groups. Group differences for motivation to exercise was found between the low and high exercise dependent groups. Consistent with the hypotheses, the high exercise dependent individuals were more intrinsically and extrinsically motivated to exercise compared to the low exercise dependent group according to the Exercise Motivation Scale. Specifically, for extrinsic motivation, the high exercise dependent individuals were more likely to exercise due to internal pressures (e.g., guilt, anxiety) and perform exercise out of choice to achieve personal goals. This is supported by Summers and colleagues (1982) who found marathon runners participated in running because of the personal challenges involved. When external sources of motivation have been internalized it creates pressure and the individual feels the need to exercise for aesthetic reasons or to prevent feelings of embarrassment if not at a peak fitness level (Pelletier et al., 1995).

For intrinsic motivation, results revealed that high exercise dependent individuals were more likely to exercise in order to: 1) explore and understand health or fitness, 2) experience the pleasure and satisfaction of accomplishing something, and 3) to experience a stimulating sensation. These results coincide with the motivation necessary for the high exercise dependent group to continually exercise in the face of obstacles and is consistent with the findings that exercise dependent individuals report high barrier self-efficacy (Hausenblas & Symons Downs, 2001). In short, these results are in agreement with the findings of Li (1999) who found that frequent exercisers displayed higher levels of intrinsic motivation to learn, intrinsic motivation to experience sensations, integrated regulation, and identified regulation.
Different reasons for exercising were also apparent between the high and low exercise dependent groups. Compared to the low exercise dependent group, the high exercise dependent group was significantly more likely to exercise to control their weight, to prevent negative mood, to be attractive to the opposite sex, for the enjoyment of physical activity, and to tone muscles. The finding that the exercise dependent group reported exercising to prevent negative mood is consistent with the DSM-IV criterion of withdrawal effects. That is, the exercise dependent individual engages in physical activity to either prevent negative mood or to promote a positive mood.

It was also found that the fitness and health reasons to exercise were not significantly different between the high and low exercise dependent groups. This finding is interesting considering that there were significant fitness level differences between the two groups. That is, the high exercise dependent group was more fit than the low exercise dependent group. Fitness and health reasons to exercise may not have differed between the two groups because the high exercise dependent group already displayed a high level of fitness and health while the low exercise dependent group had little concern for health and fitness, possibly because they lack knowledge of the benefits of exercise.

In regards to the mood traits, which was measured by the Profile of Mood States, it was found that the low exercise dependents reported significantly more tension than the high exercise dependents. Although statistically nonsignificant the high exercise dependent group reported more depression, anger, confusion, and fatigue compared to the low exercise dependent group. These results imply that high exercise dependent individuals rely on exercise to control or prevent moods such as depression, anger, and confusion. The high exercise dependent group scored higher on fatigue than the low
exercise dependent group which is consistent with their behavior because the high exercise dependent group engaged in excessive physical activity.

**Third Purpose**

The third purpose was to determine if group differences existed in regards to the physiological fitness measurements. After the appropriate computations were completed, data analysis was undertaken. Consistent with the hypothesis the high exercise dependent group had significantly higher estimated VO$_2$ max than the low exercise dependence group. As the amount of exercise training increases, VO$_2$ max also increased. Also, in accordance with the prediction the high exercise dependent group had significantly lower heart rates than the low exercise group due to adaptations within the body that occur with training.

Another consequence of regular physical activity is a lower body composition. As exercise level increases fat levels usually decrease and the amount of muscle may increase or stay the same (ACSM, 2000). Because of the physiological adaptations, individuals who are more physically active tend to have lower body composition. Consistent with the hypothesis it was found that the high exercise dependent group had lower percent body fat than the low exercise dependent group. In contrast to the hypothesis no significant group differences were evidenced for BMI. The disparity in results between the BMI and percentage body fat, both measures of body composition, may be due to the fact that percentage body fat takes muscle mass into account and is more accurate. That is, although BMI is a good indicator of body composition in epidemiological studies, BMI has a high predictive error, especially with physically
active populations (ACSM, 1996). Thus, it is conceivable for regular exercisers to have a mesomorphic body type, which may result in higher BMI, despite the fact that they have low percent body fat.

In accordance with a lower body composition, it was also found that the high exercise dependent individuals engaged in more mild, moderate, and strenuous leisure-time exercise than the low exercise group (USDHHS, 2000). Taking into account the various theories explaining the processes of exercise dependence, the difference in the frequency of strenuous activity for the high exercise dependent group, compared to the low exercise dependent group, may support the sympathetic arousal hypothesis (Thompson & Blanton, 1987). The need for an increase in exercise is one of the components of the hypothesis which can be illustrated by the increasing variance in the intensity levels of exercise determined by the Leisure-Time Exercise Questionnaire.

Limitations

Although the current study improved on many aspects of the past literature, it is not without limitations. Study limitations include: gender, age, self-report measures, deprivation period, school interference, and equations for physiological calculations. First, the use of females and an age constraint limits the generalization of the results. Future researchers are encouraged to examine exercise deprivation in males and participants of varying ages. Second, self-report measures have an inherent limitation due to socially desirable responses (Sallis & Owen, 1998). Questionnaires that require recall also have an inherent bias because of improper recollection of events. Additionally, the participants may perceive and report aspects of themselves differently than others may report about them. Thus, future research is needed using both direct and
indirect (i.e., self-report) measures of mood and exercise behavior when examining the effects of exercise deprivation.

Third, the deprivation period was only 24 hours. Although 24-hours has been shown to elicit deprivation sensations, it is plausible that a longer deprivation period could exhibit more drastic changes in mood (Modin et al., 1996). However, when a time frame longer than 24-hours is used, the likelihood of high exercise dependent individuals participating is less likely and the dropout rate increases (Szabo, 1995).

Fourth, testing was done during varying times of the school semesters. Thus, the time throughout the semester when the individual testing (e.g., midterm exams) was conducted may have effected the participants’ mood and exercise behavior. For example, if a participant completed the study during an exam period, mood and anxiety may have been elevated.

Fifth, the use of various equations to determine physiological data may result in measurement errors (ACSM, 2000). For example, there are various equations and methods to determine body density (ACSM, 1996). The skinfold method of body composition has a range of error one to two percent higher than hydrostatic weighing, the “gold standard” to assess body composition. To determine percent body fat, an age-specific equation was utilized for 18 to 80-year-old females (ACSM, 2000). Some participants were younger than 18 which may of caused their percent body fat to be slightly higher or lower than if an equation was used for 16-20 year olds. A maximal exercise test was performed to evaluate cardiorespiratory fitness and to obtain a maximal heart rate. Although maximal exercise tests are highly correlated with VO$_2$ max tests, the former is less accurate than the latter. Gas analyzers were not used in the current study,
however, to determine if maximal effort was reached due to its high cost, need for special facilities, and scheduling complexities.

Sixth, heart rate range for each participant was used to determine their exercise intensity of 70% of estimated VO₂ max. Although this allows for uniformity, participants were required to exercise at a prescribed versus self-selected exercise intensity. Recent research has found that self-selected exercise represents a more ecological valid environment and is more conducive to illiciting mood states from acute exercise bouts (Focht, 2000).

Finally, although the participants were instructed to not exercise and limit their lifestyle activity for the 24 hour deprivation period, their physical activity behavior was not directly monitored. In an attempt to have the participants answer honestly in regards to their physical activity behavior over the 24 hour deprivation period they performed the “swab test”, which was used as a manipulation check. Also, the last questionnaire completed inquired if the participant had exercised within the last 24-hours.

**Theoretical Implications**

A variety of hypotheses have been developed in the exercise dependence literature to explain the process of dependence. The findings of this study provide evidence to partially support the affective states hypothesis. The Reasons for Exercise Inventory revealed that high exercise dependent individuals participate in exercise to control mood more than low exercise dependent individuals. Whether the high exercise dependent group exercises to experience positive moods or to avoid negative moods, the desire to regulate mood is the important aspect. Although not all of the hypotheses to
explain exercise dependence were examined, results from the current study provide partial support for the affective states explanation.

**Future Directions and Conclusions**

Despite the increase in research examining exercise dependence and deprivation in recent years (Hausenblas & Symons Downs, 2001) the antecedents and consequences of exercise dependence remains unknown. Thus, there are several areas for future research in this area. First, experimenting with various exercise deprivation time periods could determine whether there is a threshold of deprivation until withdrawal symptoms are experienced (APA, 1994; Szabo, 1995). Second, the existence of exercise dependence across a variety of activities is unknown. For example, depriving an individual from an activity they enjoy may provoke greater withdrawal effects.

Third, examining the motivation of individuals in different phases of their commitment and enjoyment to exercise will aid in finding if a point exists where motivation becomes intrinsic versus extrinsic. Research on changes in motivation to exercise is crucial to increasing exercise adherence. Reasons why individuals exercise or are sedentary could further be explored to understand the differences in values and beliefs that low and high exercise dependent individuals give to exercise.

Fourth, strong conceptual and theoretical frameworks should guide the development of study hypotheses. For example, the General Theory of Addictions (see Jacobs, 1986) predicts that people with chronically abnormal arousal states (either high or low), who also tend to respond to feelings of inferiority and rejection by flight into denial and fantasy, are at the greatest risk for acquiring a dependency. This theory has been
applied to gambling, eating, and drinking addictions. Research is needed to further examine its utility for exercise dependence.

Finally, the majority of the research examining the causal mechanisms of exercise dependence has been correlational (Hausenblas & Symons Downs, 2001). Longitudinal, ecological momentary assessments, qualitative, and experimental studies are required to enhance our understanding of the etiological mechanisms of exercise dependence.

In conclusion, the present study has explored differences in low and high exercise dependent individuals and found that the groups are distinct in certain areas. Motivation and reasons to exercise, along with physiological data such as heart rate, cardiorespiratory fitness, and body composition were different between the two groups. In examining mood though, the groups were similar even after the deprivation period.
APPENDIX A
IRB APPROVAL

INSTITUTIONAL REVIEW BOARD

DATE: 24-Feb-2000

TO: Ms. Amy Hagan
    POB 118204
    Campus

FROM: C. Michael Levy, Chair
       University of Florida
       Institutional Review Board

SUBJECT: Approval of Protocol # 2000 - 154

TITLE: Exercise Deprivation and Mood

FUNDING: Unfunded

I am pleased to advise you that the University of Florida Institutional Review Board has recommended approval of this protocol. Based on its review, the UFIRB determined that this research presents no more than minimal risk to participants. Given your protocol, it is essential that you obtain signed documentation of informed consent from each participant. Enclosed is the dated, IRB-approved informed consent to be used when recruiting participants for the research.

If you wish to make any changes to this protocol, including the need to increase the number of participants authorized, you must disclose your plans before you implement them so that the Board can assess their impact on your protocol. In addition, you must report to the Board any unexpected complications that affect your participants.

If you have not completed this protocol by 24-Feb-2001, please telephone our office (392-0433), and we will discuss the renewal process with you.

It is important that you keep your Department Chair informed about the status of this research protocol.

CML:bj/js

cc: Dr. Heather Hausenblas
APPENDIX B
DRIVE FOR THINNESS SUBSCALE

Instructions. Using the scale provided below, please complete the following questions as honestly as possible. For each item, decide if the item is true about you never (1), rarely (2), sometimes (3), often (4), usually (5), or always (6). Please place your answer in the blank space provided after each statement.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
<td>Usually</td>
<td>Always</td>
</tr>
</tbody>
</table>

1. I eat sweets and carbohydrates without feeling nervous. _______

2. I think about dieting. _______

3. I feel extremely guilty after overeating. _______

4. I am terrified of gaining weight. _______

5. I exaggerate or magnify the importance of weight. _______

6. I am preoccupied with the desire to be thinner. _______

7. If I gain a pound, I worry that I will keep gaining. _______
APPENDIX C
EXERCISE DEPENDENCE SCALE

**Instructions.** Using the scale provided below, please complete the following questions as honestly as possible. The questions refer to current exercise beliefs and behaviors that have occurred in the past 3 months. Please place your answer in the blank space provided after each statement.

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Never</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

1. I am unable to reduce how long I exercise._____
2. I exercise to avoid feeling stressed._____
3. I spend a lot of time exercising._____
4. I exercise longer than I intend._____
5. I exercise despite recurring physical problems._____
6. I continually increase my exercise intensity to achieve the desired effects/benefits._____
7. I organize my life so that there is always time for exercise._____
8. I exercise longer than I expect._____
9. I am unable to reduce how often I exercise._____
10. I exercise to avoid feeling fatigued._____
11. I would rather exercise than spend time with family/friends._____
12. I think about exercise when I should be concentrating on school/work._____
13. I exercise longer than I plan._____
14. I spend a great deal of time in exercise-related activities._____
15. I exercise when injured._____
16. I exercise to avoid feeling irritable._____
17. I exercise to avoid feeling anxious._____
18. I spend most of my free time exercising._____
19. I continually increase my exercise frequency to achieve the desired effects/benefits._____
20. I am unable to reduce how intense I exercise._____
21. I exercise to avoid feeling restless._____
22. I exercise despite persistent physical problems._____
23. A great deal of my time is spent exercising._____
24. I exercise to avoid feeling tense._____
25. I choose to exercise so that I can get out of spending time with family/friends._____
26. I exercise more often than I intend._____
27. There is no better way to spend my time than to exercise._____
28. I continually increase my exercise duration to achieve the desired effects/benefits._____

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effects/benefits.

29. I exercise more often than I plan.

30. Exercise is my only recreational activity.
APPENDIX D
EXERCISE MOTIVATION SCALE

**WHY ARE YOU CURRENTLY PARTICIPATING IN THIS ACTIVITY?**

**Direction:** Please read each of the statements listed below and indicate how strongly you agree or disagree with each statement by circling the appropriate response to the right of the statement. Use the following response categories:

<table>
<thead>
<tr>
<th>Strongly disagree (SD)</th>
<th>Disagree (D)</th>
<th>Moderately disagree (MD)</th>
<th>Moderately agree (MA)</th>
<th>Agree (A)</th>
<th>Strongly agree (SA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

1. For the pleasure it gives me to experience positive sensations from the activity.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

2. For the satisfaction it gives me to increase my knowledge about this activity.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

3. Because other people believe that it’s a good idea for me to exercise.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

4. Because I must exercise to feel good about myself.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

5. Because I believe that regular exercise is a good way to enhance my overall development.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

6. Because it is consistent with what I value.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

7. I can’t understand why I am doing this.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

8. Because I feel pressure from others to participate.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6

9. Because I think that exercise allows me to feel better about myself.  
   - SD 1  - D 2  - MD 3  - MA 4  - A 5  - SA 6
<table>
<thead>
<tr>
<th></th>
<th>WHY ARE YOU CURRENTLY PARTICIPATING IN THIS ACTIVITY?</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>For the pleasure I experience while learning about this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>11.</td>
<td>For the satisfaction I feel when I get into the flow of this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12.</td>
<td>Because I feel I have to do it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13.</td>
<td>To satisfy people who want me to exercise.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14.</td>
<td>Because exercising is an important aspect of how I perceive myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15.</td>
<td>For the pleasure of understanding this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16.</td>
<td>I have no idea.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>17.</td>
<td>For the pleasure of mastering this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>18.</td>
<td>Because I think it is a good thing for my personal growth.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>19.</td>
<td>For the pleasure I experience when I feel completely absorbed in the activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>20.</td>
<td>For the satisfaction I feel while I try to achieve my personal goals during the course of this activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>21.</td>
<td>Because I would feel guilty if I did not take the time to do it.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>22.</td>
<td>Because I value the way exercise allows me to make changes in my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>23.</td>
<td>It is not clear to me anymore.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>24.</td>
<td>Because I think exercise contributes to my health.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
25. To comply with expectations of others (e.g., friends).
   1 2 3 4 5 6

26. For the enjoyment that comes from how good it feels to do the activity.
   1 2 3 4 5 6

27. Because I enjoy the feelings of discovering more about this activity.
   1 2 3 4 5 6

28. Because I enjoy the feelings of improving through participating in this activity.
   1 2 3 4 5 6

29. Because I feel that changes that are taking place through exercise are becoming part of me.
   1 2 3 4 5 6

30. For the pleasure I experience while trying to become the person I want to be.
    1 2 3 4 5 6

31. Because I would feel ashamed if I was not doing anything to improve my current situation.
    1 2 3 4 5 6
APPENDIX E
REASONS FOR EXERCISE INVENTORY

People exercise for a variety of reasons. When people are asked why they exercise, their answers are sometimes based on the reasons they believe they should have for exercising. What we want to know are the reasons people actually have for exercising. Please respond to the items below as honestly as possible. To what extent is each of the following an important reason that you have for exercising? Use the scale below, ranging from 1 to 7, in giving your answers.

1. To be slim_____
2. To lose weight______
3. To maintain my current weight _____
4. To improve my muscle tone ______
5. To improve my strength ______
6. To improve my endurance, stamina ______
7. To improve my flexibility, coordination ______
8. To cope with sadness, depression ______
9. To cope with stress, anxiety ______
10. To increase my energy level ______
11. To improve my mood ______
12. To improve my cardiovascular fitness ______
13. To improve my overall health ______
14. To increase my resistance to illness and disease ______
15. To maintain my physical well-being ______
16. To improve my appearance ______
17. To be attractive to members of the opposite sex ______
18. To be sexually desirable ______
19. To meet new people ______
20. To social with friends ______
21. To have fun ______
22. To redistribute my weight ______
23. To improve my overall body shape ______
24. To alter a specific area of my body ___
APPENDIX F
LEISURE-TIME ACTIVITY QUESTIONNAIRE

Instructions. This is a scale which measures your leisure-time exercise (i.e. exercise that was done during your free time such as intramural sports-NOT your sport/fitness class). Considering a typical week, please indicate how often (on average) you have engaged in strenuous, moderate, and mild exercise more than 20 minutes during your free time?

1. Strenuous exercise: heart beats rapidly (e.g. running, basketball, jogging, hockey, squash, judo, roller blading, vigorous swimming, vigorous long distance bicycling, vigorous aerobic dance classes, heavy weight training)
   How many times per typical week do you perform strenuous exercise for 20 minutes or longer? ________

2. Moderate exercise: not exhausting, light sweating (e.g. fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, popular and folk dancing)
   How many times per typical week do you perform moderate exercise for 20 minutes or longer? ________

3. Mild exercise: minimal effort, no sweating (e.g. easy walking, yoga, archery, fishing, bowling, horseshoes, golf)
   How many times per typical week do you perform mild exercise for 20 minutes or longer? ________
APPENDIX G
EXERCISE-INDUCED FEELING INVENTORY (EFI)

**Instructions**: Use the following scale to indicate the extent to which each word below described how you feel at this moment in time. Record your answer in the blank space provided.

<table>
<thead>
<tr>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Do Not Feel</td>
</tr>
<tr>
<td>1 = Feel Slightly</td>
</tr>
<tr>
<td>2 = Feel Moderately</td>
</tr>
<tr>
<td>3 = Feel Strongly</td>
</tr>
<tr>
<td>4 = Feel Very Strongly</td>
</tr>
</tbody>
</table>

Refreshed _____
Calm _____
Fatigued_____  
Enthusiastic____
Relaxed_____  
Energetic_____  
Happy_____  
Tired_____  
Revived_____  
Peaceful_____  
Worn-out_____  
Upbeat_____
APPENDIX H
PROFILE OF MOOD STATES

Instructions: Below is a list of words that describe feelings people have. Please read each one carefully. Circle ONE number that corresponds to the degree which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

1. Friendly . . . . . . . . . . . . 0 1 2 3 4
2. Tense . . . . . . . . . . . . . . 0 1 2 3 4
3. Angry . . . . . . . . . . . . . . 0 1 2 3 4
4. Worn out . . . . . . . . . . . . 0 1 2 3 4
5. Unhappy . . . . . . . . . . . . 0 1 2 3 4
6. Clear-headed . . . . . . . . . 0 1 2 3 4
7. Lively . . . . . . . . . . . . . . 0 1 2 3 4
8. Confused . . . . . . . . . . . . 0 1 2 3 4
9. Sorry for things done . . . . . 0 1 2 3 4
10. Shaky . . . . . . . . . . . . . . 0 1 2 3 4
11. Listless . . . . . . . . . . . . 0 1 2 3 4
12. Peeved . . . . . . . . . . . . 0 1 2 3 4
13. Considerate . . . . . . . . . 0 1 2 3 4
14. Sad . . . . . . . . . . . . . . . 0 1 2 3 4
15. Active . . . . . . . . . . . . . . 0 1 2 3 4
16. On edge . . . . . . . . . . . . 0 1 2 3 4
17. Grouchy . . . . . . . . . . . . 0 1 2 3 4
18. Blue . . . . . . . . . . . . . . . 0 1 2 3 4
19. Energetic . . . . . . . . . . . . 0 1 2 3 4
20. Panicky . . . . . . . . . . . . . 0 1 2 3 4
21. Hopeless . . . . . . . . . . . . 0 1 2 3 4
22. Relaxed . . . . . . . . . . . . . 0 1 2 3 4
23. Unworthy . . . . . . . . . . . . 0 1 2 3 4
24. Spiteful . . . . . . . . . . . . . 0 1 2 3 4
25. Sympathetic . . . . . . . . . . 0 1 2 3 4
26. Uneasy . . . . . . . . . . . . . . 0 1 2 3 4
27. Restless . . . . . . . . . . . . . . 0 1 2 3 4
<p>| | | | | |</p>
<table>
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<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
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<tr>
<td>28. Unable to concentrate</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>29. Fatigued</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>30. Helpful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>31. Annoyed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>32. Discouraged</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>33. Resentful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>34. Nervous</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>35. Lonely</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>36. Miserable</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
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<td>37. Muddled</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>38. Cheerful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>39. Bitter</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>40. Exhausted</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>41. Anxious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>42. Ready to fight</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>43. Good-natured</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>44. Gloomy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>45. Desperate</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>46. Sluggish</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>47. Rebellious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<td>48. Helpless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>49. Weary</td>
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<td>1</td>
<td>2</td>
<td>3</td>
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<td>50. Bewildered</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>51. Alert</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>52. Deceived</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>53. Furious</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>54. Efficient</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>55. Trusting</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>56. Full of pep</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>57. Bad-tempered</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>58. Worthless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>59. Forgetful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>60. Carefree</td>
<td>0</td>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>61. Terrified</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>62. Guilty</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>63. Vigorous</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>64. Uncertain about things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>65. Blushed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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APPENDIX I
FEELING SCALE

Using the scale below, please indicate how you feel **right now, at this moment**

<table>
<thead>
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<th>-5</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>very bad</td>
<td>bad</td>
<td>fairly bad</td>
<td>neutral</td>
<td>fairly good</td>
<td>good</td>
<td>very good</td>
<td></td>
<td></td>
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</table>
APPENDIX J
STATE-TRAIT ANXIETY INVENTORY

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

1. I feel calm ................................................................. 1 2 3 4
2. I feel secure ............................................................... 1 2 3 4
3. I am tense ................................................................. 1 2 3 4
4. I feel strained ............................................................ 1 2 3 4
5. I hear at ease ............................................................. 1 2 3 4
6. I feel upset ............................................................... 1 2 3 4
7. I am presently worrying over possible misfortunes ............... 1 2 3 4
8. I feel satisfied ........................................................... 1 2 3 4
9. I feel frightened .......................................................... 1 2 3 4
10. I feel comfortable ...................................................... 1 2 3 4
11. I feel self-confident .................................................... 1 2 3 4
12. I feel nervous ........................................................... 1 2 3 4
13. I am jittery ............................................................... 1 2 3 4
14. I feel indecisive .......................................................... 1 2 3 4
15. I am relaxed ............................................................ 1 2 3 4
16. I feel content ........................................................... 1 2 3 4
17. I am worried ............................................................ 1 2 3 4
18. I feel confused .......................................................... 1 2 3 4
19. I feel steady ............................................................. 1 2 3 4
20. I feel pleasant .......................................................... 1 2 3 4
APPENDIX K
POSITIVE AND NEGATIVE AFFECT SCHEDULE

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent each word applies to you right now. Use the following scale to record your answers.

1 = very slightly or not at all
2 = a little
3 = moderately
4 = quite a bit
5 = extremely

interested _____  distressed _____  excited _____
upset ______  strong _____  guilty ______
scared ______  hostile _____  enthusiastic ___
proud ______  irritable _____  alert ______
ashamed ____  inspired _____  nervous _____
attentive ____  jittery _____  determined ___
active ______  afraid ______
APPENDIX L
RATING OF PERCEIVED EXERTION

6

7  Very, very light

8

9  Very light

10

11  Fairly light

12

13  Somewhat hard

14

15  Hard

16

17  Very hard

18

19  Very, very hard
APPENDIX M
BRUCE PROTOCOL TEST REPORT

Resting Data

Heart Rate: _______________       Blood Pressure: _______________

Exercise Data

<table>
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<tr>
<th>Time</th>
<th>Speed</th>
<th>Grade</th>
<th>Heart Rate</th>
<th>Blood Pressure</th>
<th>RPE</th>
<th>Comment</th>
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<td></td>
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<td>3-4</td>
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<td>9-10</td>
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IP  0  XXX
Recovery Data

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<tr>
<th>Time</th>
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<th>Blood Pressure</th>
<th>Comments</th>
<th>Main Reason for test termination?</th>
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<td>1-2</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-4</td>
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<td></td>
<td></td>
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</tbody>
</table>

Maximum Heart Rate: ____________________
APPENDIX N
PRE PARTICIPATION QUESTIONNAIRE

Last name: ___________________________ First name: _______________________

Please check (  ) your response to the following questions: If yes, please explain.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>( ) 1. Are you currently taking any prescribed or over-the-counter medications? List the medication and its purpose. ________________</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 2. Has a physician ever told you that you have a heart condition? Explain ________</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 3. Do you feel pain or pressure in your chest, neck, shoulder(s) or arm(s) during or after physical activity?</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 4. Do you lose your balance because of dizziness or do you ever lose consciousness?</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 5. Has a physician ever told you or are you aware that you have high blood pressure?</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 6. Has anyone in your immediate family (parents, brothers, sisters) had a heart attack, stroke, or cardiovascular disease before age 50? Explain ________________</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 7. Has a physician ever told you or are you aware that you have a high cholesterol level?</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 8. Do you currently smoke?</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 9. Do you have any bone or joint problems that could be made worse by a change in your physical activity? Explain ________________</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 10. Do you have any physical or medical conditions (e.g. diabetes, recent surgery, arthritis, pregnancy, etc.) not mentioned above, or do you know of any other reason why you should not engage in physical activity? Explain ________</td>
</tr>
<tr>
<td>( )</td>
<td>( ) 11. Are you currently exercising LESS than 3 times per week. If no, please list your activities. ________________</td>
</tr>
</tbody>
</table>

________________________________________  ________________________  ____________
Signature (required)  Home phone  Date
APPENDIX O
24-HOUR HISTORY

Name: ___________________ Date: _______ Time: __________

How much sleep did you get last night? (Please circle one)

1  2  3  4  5  6  7  8  9  10 (hours)

How much sleep do you normally get? (Please circle one)

1  2  3  4  5  6  7  8  9  10 (hours)

How long has it been since your last meal or snack? (Please circle one)

1  2  3  4  5  6  7  8  9  10 11 12 (hours)

List the meal or snack eaten: ____________________________________________

When did you last have:

A cup of coffee, tea, or soda ____________________ Alcohol _______________
Smoke a cigarette, cigar, or pipe _______________ Donated blood __________
Drugs (including aspirin) ______________________ Recent illness ___________
Suffer from respiratory problems ____________________________

What sort of physical exercise did you perform yesterday? __________________

What sort of physical exercise have you performed today? __________________

Describe your general feelings by checking one of the following:

_________ Excellent _________ Bad
_________ Very Good _________ Very Bad
_________ Good _________ Terrible
_________ Neither Good or Bad
To: Volunteers for the Moods and Exercise Study

From: Amy Hagan and Dr. Hausenblas

RE: Informed Consent

The purpose of this statement is to summarize the study we are conducting, explain what we are asking you to do, and assure you that all participants in the study will be assigned a coded number. Individuals will not be identified by name but by the last four digits of their SSN and all data will be treated in strict confidence and will be locked in a filing cabinet in the exercise psychology laboratory located at Room 145 Florida Gymnasium.

We are researchers at the University of Florida. Amy Hagan is a Master’s student in exercise psychology and Dr. Hausenblas is an assistant professor in exercise psychology. We are interested in examining your moods before, after, and 24 hours after exercise or possibly no exercise. This study will require three visits. During your first visit, you will be asked to complete a series of questionnaires and then a fitness assessment will be conducted which consists of body composition using skinfold measurements and a maximal exercise test on a treadmill. Participants will perform a symptom-limited maximal treadmill test to estimate peak oxygen consumption (VO2max). The standard Bruce protocol will be used on
participants between the ages of 18-25 years. Participant heart rate will be continually monitored while blood pressure and rating of perceived exertion will be monitored during each stage. There is an inherent risk in testing any individual during exercise that includes intensities up to and including maximal effort. The risk is about one non-fatal event in approximately 5,000 maximal exercise tests and one fatal in every 25,000 tests (ACSM, 1995). The first visit will take approximately one hour. During the second visit, you will complete a questionnaire, perform 30 minutes of activity on a piece of cardiovascular equipment and then complete a questionnaire again. The last visit, 24 hours after performing exercise during the second visit, will take approximately 15 minutes and consists of a series of questionnaires. The benefits associated with this study are knowledge of body composition and aerobic capacity. There will be no compensation.

Participation in this study is voluntary and you may withdrawal at any time without penalty. It is hoped that you will agree to take part in this study. Without the cooperation of volunteers such as yourself, projects of this type would not be possible. Please ask any questions you may have at this time, and if you have any additional questions or concerns during the course of the study, please contact Dr. Hausenblas (392-0584 ext. 292). Questions or concerns about research participants’ rights may be directed to the UFIRB Office, Box 112250, University of Florida, Gainesville, FL 32611-2250 (392-0433).

If you have no further questions at this time, and if you agree to volunteer to become involved in this study, please read the following statement and sign your name in the signature blank below.
I have read the procedure above and agree to voluntarily participate.

Participant’s signature: ________________________________________________

Date: ____________________

Principal Investigator’s Signature: ________________________________
LIST OF REFERENCES


I, Amy Hagan, was raised in Florida and completed all of my education in this state. I was in a Magnet program in high school (Center for Advanced Technologies) and focused on computer programming and animation in addition to various science-related research. The University of Florida has been my school of choice for both my undergraduate and graduate studies. As an undergraduate, I specialized in Fitness/Wellness and as a graduate student, began the program studying clinical exercise physiology then switched to exercise psychology. I plan on obtaining my Ph.D. and then teaching and do research at a University.