1995

Psychological coping strategies in rowers as measured by the Sports Inventory for Pain

Becky Metz
Ithaca College

PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

by

Becky Metz

An Abstract

of a thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in the School of
Health Sciences and Human Performance
at Ithaca College

May 1995

Thesis Advisor: V. L. Eskridge, Ph.D.

ABSTRACT

Psychological pain coping strategies of rowers were investigated. Fifty-eight rowers from a Division III college participated as subjects. The Perceived Pain Inventory (Melzack, 1987) and the Sports Inventory for Pain (SIP) (Meyers, Bourgeois, Stewart, & LeUnes, 1992) were administered before, during, and after an intense rowing ergometer workout. Seven 2 X 2 X 3 (gender X experience X trial) mixed model ANOVA's were performed on the raw data. Significant findings were analyzed with Simple Effects, Dunn-Bonferronni, and Tukey post hoc tests. Results indicate that perceived pain increased for all subjects, ($F_{(2,108)}$ = 124.01, p = .000) with novice women reporting significantly higher levels than varsity women and novice men at mid- (varsity women, $F_{(1,22)}$ = 20.72, p = .000; novice men, $F_{(1,29)}$ = 11.73, p = .002) and post-workout (varsity women, $F_{(1,22)}$ = 12.66, p = .002; novice men $F_{(1,29)}$ = 7.78, p = .009). Scores on the Coping construct increased from pre- to post-workout ($F_{(2,108)}$ = 3.06, p = .051). Pre-workout scores on the Cognitive construct were higher for novices ($F_{(1,162)}$ = 5.12, $p < .05$). However when in pain, scores of the novices were similar to that of the varsity rowers. Mid-workout scores for Body Awareness were higher for men than women ($F_{(1,54)}$ = 7.37, p = .009) and novice scored higher than varsity ($F_{(1,54)}$ = 4.35, p = .042). Conclusions: a) reported coping strategies of rowers were positive, indicating a high ability to perform while in pain, and b) the introduction of exercise-induced pain altered reported pain coping strategies on three of the five construct measures of the SIP. Further research is needed to establish the SIP as a useful measure of an athlete's ability to cope with pain.

PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

A Thesis Presented to the Faculty of
the School of Health Sciences
and Human Performance
at Ithaca College

In Partial Fulfillment of the
Requirements for the Degree
Master of Science

---

by
Becky Metz

May 1995

Ithaca College
School of Health Sciences and Human Performance
Ithaca, New York

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE THESIS

This is to certify that the Master of Science Thesis of
Becky Metz

Submitted in partial fufillment of the requirements for the degree of Master of Science in the School of Health Sciences and Human Performance at Ithaca College has been approved.

Thesis Advisor:

Committee Member:

Candidate:

Chairperson, Graduate
Programs in Physical
Education:

Dean of Graduate
Studies:

Date: May 5, 1995

ACKNOWLEDGEMENTS

I would like to thank Dr. Eskridge, Dr. Keller, Dr. McManis, Dr. Sforzo, Dr. Fisher, Dan Robinson, Anita Krook, Ward Romer, Todd Kennett, and the 1992-1993 Ithaca Crew for their support and assistance throughout this project.

PREFACE

There is poetry to rowing. The graceful motion of the stroke propels the delicate shell through the still water. Eight rowers slide forward as one, drop their oars into the water, catch the momentum and pass it on, release the water, and listen for the rush beneath the boat. This motion is repeated endlessly. Captive to its rhythm, the rowers forget their separateness.

Then there is the pain of rowing. Rowing is second only to cross-country skiing in the demands it puts on the athlete. Ideally the rower, in a race, passes out on the stroke that propels the boat across the finish line. For the rower, pain is a signal of reaching the edge of one's limits. The longer one can endure pain, the stronger one becomes. The athlete who can endure pain surpasses the boundaries set by pain and experiences a sense of immortality (Lewis, 1992).

TABLE OF CONTENTS

List of Tables

List of Figures

PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

by

Becky Metz

A Proposal for a Thesis Presented to
the Faculty of the School of
Health Sciences and Human Performance
at Ithaca College

In Partial Fulfillment of the
Requirements for the Degree
Master of Science

May 1995

Thesis Advisor: V. L. Eskridge, Ph.D.

INTRODUCTION

Athletes and coaches recognize that individuals differ in their performance capabilities while experiencing exercise-induced, exertional pain. Bill Koch, the 1976 Olympic silver medalist in cross-country skiing, thought that 90% of his success could be attributed to his ability to cope with pain (Whitmarsh & Alderman, 1993). Jeanne Flanagan, five time National Rowing Team member and 1984 Olympic gold medalist, stated that at her level of competition success depended upon mental conditioning more than physical. In fact, she considered rowing to be 80% mental at the world-class level (L. Lewis, 1992).

Rowers are a specific group of athletes that regularly encounter exercise-induced, exertional pain during intense practices and competition. During the latter part of a race, rowers are in acute pain. Their legs burn, they are short of breath, and they often feel that they are going to 'die' of exhaustion. Yet, this pain is familiar from their training, which teaches them that they will survive pain and they can push beyond it. Some rowers develop 'tricks' to cope with pain. Kristi Norelius, a member of the 1984 Olympic gold medal women's eight, labeled the burning in her legs as a cozy warmth instead of a raging fire (L. Lewis, 1992). For Brad Lewis, the 1984 Olympic gold medalist in the men's double scull, intense rowing produced a wild, raw, electric feeling of pure energy. "I welcomed the challenge, and I relished the inevitable pain" (B. A. Lewis, 1990, p. 88). Since exercise-induced, exertional pain and coping with this pain are experiences shared by successful rowers, early detection and directional development of coping strategies, through psychological training, may improve performance at all levels.

There are a number of tools that identify attitudes, beliefs, and coping strategies in chronic pain patients (Strong, Ashton, & Chant, 1991; Williams & Keefe, 1991; Schwartz, DeGood, & Schutty, 1985). However, the Sports Inventory for Pain (SIP) is the only such tool designed to identify attitudes toward pain and psychological coping strategies specifically in athletes (Meyers, Bourgeois, Stewart, & LeUnes, 1992). The statements that comprise the SIP are all sport situational primarily relating to athletic injury and pain associated with injury. Meyers, Bourgeois, Stewart, and LeUnes (1992) allude that the SIP may be a predictor for athletic performance and adherence to exercise programs.

The two main purposes of this study are: a) to identify psychological pain coping strategies in rowers, and b) to determine if reported pain coping strategies change when exercise-induced pain is present. The Perceived Pain Inventory (PPI) (Melzack, 1987) will be administered to measure perceived pain and the SIP (Meyers, Bourgeois, Stewart, & LeUnes, 1992) will be utilized to categorize and quantify psychological coping strategies. Perceived pain and coping strategies will be compared between men and women, and between varsity and novice rowers. This study will address several theoretical hypotheses outlined below:

1. Rowers will be more likely to agree with the statements comprising the SIP constructs that are considered positive and will be less likely to agree with statements that comprise the SIP constructs that are considered negative.

2. An increase of perceived exercise-induced pain will occur during an intense interval workout on the Concept II rowing ergometer.

3. No change on any of the SIP construct scores will occur from pre- to mid- to post-workout, regardless of gender or experience level.

REVIEW OF THE LITERATURE

In this review of the literature the following topics are discussed: (a) definition of pain, (b) pain in athletics, (c), influence of experience on coping strategies for pain, (d) influence of gender on coping strategies for pain, (e) rowing as an exertional force, and (f) measurement tools.

Definition of Pain

The phenomenon of pain is multidimensional, involving the complex interaction of physiological, neurological, biomechanical, psychological, emotional and affective dimensions. Prior to the adoption of a definition of pain by the International Association for the Study of Pain (IASP), pain was described in a multitude of ways (Bonica, 1990; Merskey, 1979; Wall, 1984). Some clinicians and scientists attempted to define pain, while others insisted that pain was simply undefinable. The general definition adopted by the IASP is as follows: "pain: an unpleasant sensory and emotional experience associated with actual tissue damage or potential tissue damage or described in terms of such damage" (Bonica, 1990, p.18). A rather extensive note was added to this definition.

> Note: Pain is always subjective. Each individual learns the application of the word through experiences related to injury in early life. Biologists recognize that stimuli that cause pain are likely to damage tissue. Accordingly, pain is the experience that we associate with actual or potential tissue damage. It is unquestionably a sensation in a part or parts of the body, but is unpleasant and therefore also an emotional experience. Experiences that resemble pain (e.g., pricking) but are not unpleasant should not be called pain. Unpleasant abnormal experiences (dysesthesiae) may also be pain but are not necessarily so because, subjectively, they may not have the usual sensory qualities of

> pain. Many people report pain in the absence of tissue damage or any likely pathophysiologic cause; usually this happens for psychologic reasons. There is no way to distinguish their experience from that due to tissue damage if one takes a subjective report. If they regard their experience as pain and if they report it in the same ways as pain caused by tissue damage, it should be accepted as pain. This definition avoids tying pain to the stimulus. Activity induced in the nociceptor and nociceptive pathways by a noxious stimulus is not pain, which is always a psychologic state, even though most pain has a proximate physical cause. (Bonica, 1990, pp. 18-19)

This lengthy description further supports the complex multidimensional nature and difficulty of parsimoniously defining pain. Mountcastle (1980) and Rapport (1979) describe pain as a function of two components: (a) sensation of pain, which is based on an individual's perception of pain, and (b) reaction to pain, which is expressed as behavioral or psychological coping strategies.

<u>Perception of Pain</u>

In psychological research, the measurement of the sensation of pain is based on an individual's perception of pain (Mountcastle, 1980). Two equally noxious stimuli can be perceived and reported differently by different individuals at different times (Hall & Davies, 1991; Jaremko, Silbert, & Mann, 1981). A potential pain producing stimulus is detected in the neuron endings, transmitted to, and initially registered in the brain. This information is processed and relayed to the conscious mind (Rapport, 1979). The conscious mind perceives this stimulus and the subject reports this perception in terms of sensation. Research involving the measurement of pain sensations includes perceived intensity

(Hall & Davies, 1991), pain coping strategies (Jaremko et al., 1981) pain tolerance, pain threshold (Otto & Dougher, 1985; Ryan & Koviac, 1966; Walker, 1971), and perceived exertion (Morgan, 1973; Winborn, Meyers, & Mulling, 1988). Each of these pain measurements share the common premise that pain is present (i.e., the potential pain producing stimulus is perceived as pain by the individual).

Coping with Pain

Coping has been defined as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p. 141). Coping is a process and should not be confused with outcome. If an individual is failing to achieve a specific goal, it can not be assumed that they are not using coping mechanisms. The individual may be attempting to cope, but the coping strategies selected are ineffective, inefficient, or inappropriate for the given situation. It may be that the pain sensation exceeds the capability of the coping strategies. In most cases, it is the psychological coping mechanism that is the limiting factor in the continuation of activity associated with pain (Rapport, 1979). Coping has been recognized as a mediating factor in stress relationships in athletics (Crocker, 1992). Athletes use a wide range of psychological and behavioral coping strategies to manage sports related stress. These stressors include competition, pressure from teammates and coaches, and pain associated with their sport (Puffer & McShane, 1992).

Pain in Athletics

Pain is an integral part of athletics. In order to continue with physical activity while experiencing pain, one must react to the sensation of pain and employ behavioral or psychological coping strategies. Athletes, coaches, and athletic trainers may not enjoy the pain associated with sport. However, pain is an accepted, as well as an expected, aspect of sport participation. Pain acceptance is characterized by a willingness to experience pain, whereas pain expectancy is the anticipation of unavoidable pain in a given situation (Ryan & Kovacic, 1966). Athletes in pursuit of excellence are frequently exposed to exercise-induced exertional pain of muscle fatigue, cardiovascular stress, muscular strain, or trauma due to contact. For optimum performance, it is necessary for athletes to push their limits and endure pain in both practice and competition (Walker, 1971). The two most common classifications of physiologic pain that athletes experience are: (a) pain due to exertion, and (b) pain due to acute trauma.

Pain Due to Exertion

Exercise-induced exertional pain increases in intensity until the muscle contraction stops and circulation is restored. The stimulus for this type of pain is due, in part to muscle ischemia, which is a condition resulting from an inadequate supply of oxygen and fuel to the contracting muscle.

The primary energy source utilized during exercise is adenosine triphosphate (ATP). The greatest amount of ATP is produced by breaking down various fuels (e.g., glucose) in the presence of oxygen (Mills, Newham, & Edwards, 1984). If oxygen is not present, the production of ATP is decreased and the output of additional by-products is increased.

There are three major processes for ATP production in the muscles: (a) creatine phosphate, (b) glycolysis, and (c) oxidative metabolism (Lamb, 1984).

Creatine Phosphate (CP). The CP system is activated almost instantaneously to produce ATP for use during short bouts of high intensity activity that lasts 30 seconds or less. These high intensity, short duration activities are performed using the immediate fuels from glycolysis and are concluded before the oxidative recovery processes are fully activated. Therefore, the breakdown of CP does not require oxygen and is classified as an anaerobic energy source (Lamb, 1984; Morehouse & Miller, 1963).

Glycolysis. Glycolytic energy production can be an aerobic or anaerobic process. Aerobic energy production occurs when glucose is broken down in the presence of oxygen, resulting in 4 ATP and pyruvic acid. As long as oxygen is present, pyruvic acid can be converted to acetyl Co-A, which can enter the Kreb's cycle and produce additional ATP. Anaerobic gylcolsis occurs when glucose is broken down without the presence of oxygen with the net result of 2 ATP and lactic acid (Lamb, 1984). Lactic acid is formed by binding the excess H+ ions to pyruvic acid with the catalytic enzyme lactate dehydrogenase. The formation of lactic acid provides a means for the highly acidic H+ ions to get out of the cell, allowing for energy production to continue. This system is utilized in activities requiring explosive exertion from 1 to 3 min. It is limited by the amount of H+ binding to the co-factors NADH and $FADH_2$, wherein H+ ions are transported to the electron transport system for additional production of ATP.

Excessive lactic acid in the muscle tissue is thought to produce discomfort, and even pain (Morehouse & Miller, 1963). However, recent research has concluded that it is the H+ activity and the corresponding acidity that disrupts the balance of the cell. Blood lactate level is only a measure of anaerobic glycolysis and reflects the amount of H+ ions that are being transported out of the cell (Vander, Sherman, & Luciano, 1994).

Oxidative Metabolism. Sustained oxidative or aerobic energy production is dependent on the presence of oxygen. Oxidative metabolism is comprised of the Kreb's cycle and the electron transport system (ETS), and it produces greater than 90% of the ATP synthesized. During the Krebs cycle, acetyl Co-A is degraded through a series of chemical reactions into 2 ATP, 6 NADH, and 2 $FADH_2$. The electron transport re-oxidizes H+ from NADH and $FADH_2$ to yield 22 ATP and returns the co-enzymes to usable forms (Vander, Sherman, & Luciano, 1994). Oxidative metabolism is predominant during prolonged exertion of 4 minutes or more. The limiting factors of this system are the transport of oxygen by the circulorespiratory system, the extraction of O_2 from the blood into the muscle cell (Lamb, 1984; Morehouse & Miller, 1963), the presence of an electron donor (NADH or $FADH_2$) and sufficient enzymes to catalyze the chemical reactions (Vander, Sherman, & Luciano, 1994).

Of the three mechanisms the body uses to produce ATP for utilization by the muscles, oxidative metabolism is the most efficient. It is effective during long duration, medium intensity activities. However, as the intensity of exercise increases and the oxygen demand exceeds the supply, there is a shift from aerobic to anaerobic metabolism. This shift is beneficial by allowing for the continued production of energy when the oxygen supply is insufficient for aerobic energy production, but will result in the production of detrimental by-products.

Pain Due to Acute Trauma

Injury is damage to the tissue resulting from trauma. Pain accompanying an injury is different from pain induced by exercise. Unlike exercise-induced pain, which dissipates with the cessation of exercise, pain associated with injury is of a longer duration. However, in the whole schema of pain, most athletic trauma-related pain is still considered to be acute in nature (Mills et al., 1984). Pain induced by trauma may result from tears in the muscle fibers and/or connective tissue, muscle spasms (McArdle, Katch, & Katch, 1986), a build up of noxious chemicals, muscle swelling (Ebbling & Clarkson, 1989), and nerve damage.

While pain may be a measure of an athlete's limits, it may also be a signal that there is something wrong. Enduring pain, of the right nature extends physiologic boundaries. However, too much pain or the wrong types of pain can deter performance and possibly injure the athlete. It is important that an athlete who experiences pain is aware of her/his body and monitors the pain she/he is experiencing. This is called association. Elite marathoners report using association strategies in order to focus on bodily response and remind themselves to relax and stay loose. Dissociative behavior or distracting oneself from the pain is more common among average and lower level athletes (Morgan, 1978). Dissociative strategies can lead to overuse injuries such as tendonitis, bursitis, and stress fractures.

Influence of Experience on Coping Strategies for Pain

There is an experiential component in how an individual perceives, reacts to, and copes with painful situations. It is assumed that learning occurs with experience and plays a role in the development of pain coping strategies. Although there are a multitude of learning classifications, three categories are discussed below that appear to be the most useful when considering the role of learning on the pain phenomenon: (a) instructional, (b) operant, and (c) social learning (Chapman & Turner, 1990).

Instructional Learning

Instructional learning involves the use of input from an outside source (e.g., teacher, text). In essence, it provides the individual with raw material to build psychological coping strategies to deal with pain. It is commonly accepted that coping with pain associated with dental or medical procedures can be enhanced by educating the patient about the treatment and the nature of the sensations they will likely experience (Chapman & Turner, 1990). It is logical that instructional learning could play a roll in pain coping for athletes as well. If psychological pain coping strategies can be identified and changed through instruction, than athletes could benefit from receiving such instruction in the use of the most effective coping strategies.

Operant Learning

Operant learning refers to ongoing changes in behavior that occur because of the incidents following the event. It is based on the empirical law of effect, which states that any event followed by an event favorable to the individual, is more likely to occur again when a similar situation arises (Chapman & Turner, 1990). Operant learning is not necessarily conscious. Therefore, the development of both positive and negative coping strategies can occur. Controlling operant learning, bringing it to consciousness, relates to the idea of self-regulation. Such self-regulation would allow advanced athletes to plan, organize, execute, and monitor their training. In addition, self-regulation would most likely allow these athletes to endure physical pain and emotional stress to reach optimum performance (Chen & Singer, 1992).

Social Learning

Social learning or modeling is considered one of the major modes of human learning. Modeling refers to the imitation of another individual in a similar social setting. Calm, controlled models who are experiencing pain will generally influence an observer to respond in a similar fashion. Similarly, a model who is expressive and complaining will often induce an observer to react hypersensitively to painful situations (Chapman & Turner, 1990). Social learning is based on social norms and societal roles for age, economic status, and gender.

There are several examples of learning in the pain tolerance literature. For instance, Ryan and Koviacic (1966) examined pain tolerance in males and compared among contact athletes, non-contact athletes, and non-athletes. They reported that the contact athletes had the highest level of pain tolerance. One explanation for the differences was that the contact athletes had previous experience with the two types of pain utilized in the test and, therefore, learned that this pain was not harmful. The learning that occurred was a combination of instructional (e.g. information from coaches and trainers), operant (trial and error of practice situations), and social (modeling of superior teammates). In contrast, the non-athletes and the non-contact athletes had little or no experience with the types of pain utilized in the test and, therefore, had fewer opportunities to learn the final result of the pain or strategies for coping with this type of pain.

Walker (1971) performed a similar study on female subjects. Pain tolerance was compared between athletes and non-athletes. Athletes were not divided into contact and non-contact sub-categories. The results were similar to those found by Ryan and Koviacic (1966). Athletes demonstrated performance superior to that of non-athletes on all measures of pain tolerance.

Experience alone does not guarantee that a specific learning will occur. However, the differences continually found in research between experienced athletes, non-athletes, and inexperienced athletes might be explained as: (a) Only those individuals with specific characteristics associated with pain become athletes, (b) individuals learn to develop characteristics and/or coping strategies associated with pain through their ongoing sports experiences, or (c) some combination of (a) and (b).

Influence of Gender on Coping Strategies for Pain

Research in the 1960's and the 1970's was strongly supportive of differences between males and females on psychological and behavioral aspects with respect to pain. Although these differences existed in experimental research, there was no link connecting these findings to biological causes. In fact, the majority of these differences can be explained through social learning and the rigid social expectancies of gender roles set by society (Harris, 1981; Miller & Kirsh, 1987; Otto & Doughter, 1985). Traditionally, society's goal of gender socialization has been to instill gender appropriate attributes on its members. This would allow members to successfully carry out the roles that society had assigned to them (Harris, 1981). The attributes of a successful athlete (e.g., aggression, strength, and dominance) were not considered compatible with society's image of the ideal female (Die & Holt, 1989). This conflict results in confusion with regard to roles and perceptions of women in sport. There are several ways for women to resolve this conflict. One way is to withdraw from sport entirely. Another is to focus on sports that are considered feminine appropriate such as swimming, gymnastics, or tennis. However, there is another option. As societal trends have developed that diminish the gender role differentiations in sport environments, a wider latitude of attributions are deemed acceptable for females engaging in athletics. One can be athletically skilled and maintain a sense of feminity (Harris, 1981).

When studying non-athletes only, higher pain responsivity has been recorded for males when compared to females (Otto & Dougher, 1985). This is consistent with studies reviewed by Feine, Bushnell, Miron, and Duncan (1991) on acute and chronic pain patients. They found that women reported greater incidence of acute and persistent pain, lower pain thresholds, and pain ratings to be more severe. Gender affects on early studies utilizing the Sports Inventory for Pain (SIP) followed similar patterns. Differences between females and males occurred on four of the six coping subscales. Specifically males scored significantly higher on the positive constructs coping (COP) and cognitive (COG) and the composite index HURT, whereas females scored significantly higher on the negative construct catastrophizing (CAT). It is possible that these gender differences reflect the sample pool selected to test the initial utility of the SIP. The SIP was originally administered to subject pools of college students in general rather than to athletes specifically (Meyers, Bourgeois, Stewart, & LeUnes, 1992).

The SIP was intended for use with athletes. In one study utilizing the SIP with college rodeo athletes, the only difference between males and females was on the body awareness (BOD) subscale. Specifically, males scored significantly higher than females (Meyers, Bourgeois, LeUnes, Erick, & Halvelká, 1992). In another study, in which the SIP was administered to high and low ability runners, gender differences occurred on two of the six subscales. Differences were found on the CAT and the BOD constructs (Reed, Bourgeois, & LeUnes, 1992). Females scored significantly higher on the negative construct CAT, while males scored significantly higher on the BOD construct. It is important to note that the BOD subscale is still in the developmental stage as a moderator variable for the SIP. Although the SIP was intended for use with athletes, the SIP's approach focuses on traumatic pain and injury rather than exercise-induced exertional pain.

There is a notion that athletes, especially females, follow a different set of social learning factors than their non-athletic counterparts. This notion is emphasized with respect to pain incurred through athletic competition. Present research shows that male and female athletes respond similarly to the pain experience (Hall & Davies, 1991; Mahoney, Gabrial, & Perkins, 1987). Hall and Davies (1991) examined gender differences in perceived intensity and affect of pain between athletes and non-athletes. Results of their study indicated that female non-athletes reported significantly higher pain intensity than the other three groups, also the female non-athletes reported significantly higher pain affect than the female or male athletes, but did not differ significantly from the male non-athletes. Male non-athletes differed from male athletes by reporting significantly higher pain intensity and pain affect. No significant differences in pain intensity and pain effect were present between male and female athletes. Mahoney and colleagues (1987) found similar results when comparing psychological skills between genders, and between college and elite athletes. No differences in psychological skills were evident between male and female elite athletes. In another study, performed by Jaremko et al. (1981), female athletes showed a higher tolerance for aversion stimulation, higher thresholds on the cold pressor, and more skilled use of cognitive coping strategies than male athletes, male non-athletes and female non-athletes. Again, the female non-athletes showed the least tolerance of any group tested.

Males and females are similar in many psychological aspects. The differences that do occur seem best explained by socialization theories, rather than biological ones. Because society continues to hold onto socializing and differentiating roles, there is some concern that female athletes may experience more role conflict than do male athletes (Harris, 1981). However, athletes appear to be more similar behaviorally and psychologically, regardless of gender, than do their non-athletic counterparts (Hall & Davies, 1992).

Rowing as an Exertional Force

For athletes to become stronger, faster, and more fit, physiological limits need to be pushed, resulting in the elicitation of pain. In certain sports such as swimming, running, and rowing, the ability of the athlete to endure exertional pain is critical to achieve optimum performance. Rowing is a sport that specifically requires explosive exertion of one motion repeated for 6 to 8 min. Training for rowing involves stressing all three energy systems, the CP system, glycolysis, and oxidative metabolism. Training programs are specifically designed to stress these systems and elicit a painful response. This practice is based on the well established theory that to facilitate improvements, the system involved must be progressively overloaded or placed under stress (Lamb, 1984; McArdle et al., 1986; Roy & Irvin, 1984). Thus, rowers are good subjects for studying exercise-induced, exertional pain and the psychological coping strategies that accompany that pain.

Measurement Tools

Tools for measuring perceived pain intensity and pain coping strategies are needed for this study. The Perceived Pain Inventory was selected to quantify perceived pain and the Sports Inventory for Pain was selected to quantify psychological coping strategies.

Perceived Pain Inventory (PPI)

Various methods of qualifying and quantifying pain are described in the literature (Jensen & Karoly, 1992; Melzack & Katz, 1992). The McGill Pain Questionnaire (MPQ) has become the most widely used tool for the measurement of pain, primarily in the clinical setting for chronic pain. The MPQ takes about 5-10 minutes to administer and provides feedback on both the intensity and quality of pain (Melzack, 1987). The portion of this tool that measures pain intensity is termed the Perceived Pain Inventory (PPI) and is based on the selection of a number-word descriptor of pain. The Pain Rating Index (PRI) is the quality measure of the MPQ and is based on the rank value of selected pain descriptors (Melzack & Katz,1992).

The PPI will be the only portion of the MPQ utilized in this study. Jensen, Turner, and Romano (1992) provided two reasons for the inclusion of perceived intensity as a moderator variable when studying pain. First, it is possible that an individual's perception of pain intensity may influence coping efforts. For example, individuals with higher levels of perceived pain may simply quit rather than find a way to cope and continue. Second, perceived pain intensity may affect an individual's perception about which coping strategies are effective. For example, individuals with low perceived pain intensity may find relaxation or distraction to be most beneficial.

Sports Inventory for Pain (SIP)

There are a number of studies that utilize tools to identify attitudes, beliefs, and coping strategies in chronic pain patients (Strong, Ashton, & Chant, 1992; Williams & Keefe, 1991; Williams & Thorne, 1989; Schwartz, DeGood, & Schutty, 1985; Rosenthiel & Keefe, 1983). The SIP is a relatively new tool designed to identify an athlete's psychological coping strategies. Currently the SIP is the only such tool designed for pain incurred through sport participation. The statements that comprise the SIP are sport situational. Approximately half of the statements relate specifically to pain associated with athletic injury.

The SIP was developed by generating a pool of coping responses identified by injured athletes. Additional pain descriptors, identified by the general population were incorporated by administering the Coping Strategies Questionnaire (CSQ) (Rosenthiel & Keefe, 1983), the Pain Impairment Scale (PAIRS) (Riley, Ahern, & Follick, 1988), and the Controlled Repression-Sensitization Scale (CR-S) (Handel, 1973). The SIP identifies five constructs: coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), and body awareness (BOD) that represent positive and negative coping styles. These five constructs are represented by the collapsed scores of the individual statements (Meyers, Bourgeois, Stewart, & LeUnes, 1992). There is a sixth category HURT, which is the calculated composite score of the SIP.

Meyers, Bourgeois, Stewart, & LeUnes (1992) allude that the SIP may be a beneficial predictor for athletic performance and adherence to exercise programs. However, enduring pain due to injury, as they suggest, and enduring pain due to exertion may be two different experiences the athlete potentially faces.

Summary

Although the definition of pain is extensive, the sensation of pain is a common phenomenon. The pain sensation is first initiated by the perception of the potential pain producing stimulus and then followed by a reaction to that sensation. Athletes experience pain due to a multitude of factors, which are most simply classified as exertional and traumatic pain. Research with athletes indicates that both experience level and gender may affect the way individuals perceive, react to, and cope with painful situations. Rowers are one group of athletes who regularly and deliberately experience exertional pain during intense workouts and competitions. The PPI and the SIP were selected as the measurement tools for quantifying pain intensity and psychological pain coping strategies in rowers during an intense workout.

METHODS AND PROCEDURES

This section details the methods and procedures that will be used in this investigation. A detailed description of the following are presented in this section: (a) selection of subjects, (b) testing instrumentation, (c) procedure, (d) scoring of data, (e) treatment of data, and (f) summary.

Selection of Subjects

Data will be collected on a minimum of 40 volunteer subjects. Subjects will be varsity and novice rowers at Ithaca College who are actively participating in the winter training program. They will be both male and female and range in age from 18-22 years. Rowers will be informed of the study through flyers (Appendix A-1) or through personal contact with permission from their coach. Once informed, rowers will be asked to volunteer. No inducements will be offered. Approximately 100 crew members are eligible for participation in this study. Once selected, the subjects will be classified by gender and experience level. Novice rowers are defined as first year rowers with fewer than 12 months of competitive rowing experience. Varsity rowers have had 2 or more years of competitive rowing experience.

Testing Instrumentation

Two different tools will be used in this study. The Perceived Pain Inventory (Melzack, 1987) will be utilized to quantify perceived pain reported by the subjects. The primary tool, the Sports Inventory for Pain (Meyers, Bourgeois, Stewart, & LeUnes, 1992) will be used to identify and measure the psychological coping strategies in the rowers. These tests will be administered immediately before, at the mid-point, and immediately after an intense rowing training session.

Perceived Pain Inventory (PPI)

The intent of this study is to have the subjects experience exercise-induced exertional pain by performing an intense rowing workout, and in doing so, create a situation where the subjects will employ psychological coping strategies to continue with the physical activity. Therefore, a moderator variable will be included to measure the amount of perceived pain experienced by the subjects. The PPI portion of the McGill Pain Questionnaire will be utilized as the measure of pain intensity. The PPI (Appendix A-2) is a self-report written scale consisting of five pain descriptives ranging from 0 (none) to 5 (excruciating) (Melzack, 1987).

Sports Inventory for Pain (SIP)

The SIP is a written questionnaire that consists of 25 statements representing five coping factors: coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), and body awareness (BOD) (Appendix A-3). Each statement is followed by a Likert-type scale, which ranges from 1 (strongly disagree) to 5 (strongly agree). There are eight statements related to COP, five related to COG, four related to CAT, four related to AVD, and four related to BOD.

There is a sixth category HURT, which is the calculated composite score of the coping factors. The HURT index is a compilation of the positive factors (COP and COG) minus the negative factors (CAT and AVD). HURT is designed to be a quantitative representation of the general coping style of the individual. The HURT index does not include the BOD construct. BOD is a moderator variable and was designed by Meyers, Bourgeois, Stewart, and LeUnes (1992) as a measure of response style, specifically the extent of hyposensitivity or hypersensitivity to physiologically produced sensory stimuli. Published results on the development of the SIP indicate test-retest reliability coefficients ranging from r = .69 to .88 and Cronbach's coefficient alpha levels for internal consistency ranging from r = .61 to .88 (Meyers, Bourgeois, Stewart, & LeUnes 1992).

Procedure

All data will be gathered at Haskel Davidson Boathouse during a scheduled team practice. Prior to the beginning of the practice, all rowers will be given an informational sheet (Appendix A-4) about the study. Those who volunteer to participate as subjects will be instructed to keep the informational sheet and will be given a biographical data form (Appendix A-5) to complete. Those who decide not to volunteer will participate in practice but will not complete the study questionnaires. Subjects will be allowed to warm-up as they choose before beginning the interval workout.

The practice will consist of an interval workout on the Concept II rowing ergometer (Concept II, Morrisville, VT). The Concept II rowing ergometer is an exercise machine that simulates the rowing motion in competitive crew racing. It is a standard training and testing apparatus used by collegiate and national rowers during land training. Subjects will perform four sets of four 1-min pieces of rowing at maximum power on the ergometer. To monitor intensity and effort throughout the workout, heart rate, and distance rowed (meters) will be monitored after each 1-minute piece on the workout form (Appendix A-6). There is a 2-min rest scheduled after each 1-min piece and a 5-min rest scheduled after each set of four pieces. Stroke rate should be consistent throughout the workout at 31 strokes per minute (spm) ± 2 spm.

The PPI (Melzack, 1987) and the SIP (Meyers, Bourgeois, Stewart, & LeUnes, 1992) will be administered immediately before, at the mid point, and immediately after the interval workout.

Scoring of Data

The single number indicated on the PPI represents the subject's perceived pain at a given point in time. Each subject will have three PPI scores, one for each test administration.

The SIP utilizes a five-point Likert-type format ranging from 1 (strongly disagree) to 5 (strongly agree). Each statement is categorized into appropriate constructs (Appendix A-7). The numbers indicated by the subject for each statement are added to obtain the total for each of the five constructs. The composite HURT score is calculated by adding the scores from the positive constructs COP and COG, and subtracting the scores from the negative constructs, CAT and AVD (HURT = COP + COG - CAT - AVD). Collapsing the data will result in 18 scores for each subject, six scores (COP, COG, CAT, AVD, BOD, and HURT) for each of the three administrations of the SIP.

Treatment of Data

Seven 2 X 2 X 3 (gender X experience X trial) mixed model analyses of variance (ANOVA) will be performed on the raw scores of the PPI and the construct scores (COP, COG, CAT, AVD, BOD, and HURT). The .05 level of significance has been established as acceptable for rejecting the null hypotheses. Statistical analysis will be performed using the SPSSX computer program. Significant findings will be submitted to post-hoc tests: Simple Effects or Dunn-Bonferronni for the significant interactions and Tukey for the significant main effects (Hopkins, Glass, & Hopkins, 1987). Heart rate and the number of meters completed after each 1 min piece will be examined to monitor consistency and intensity of effort.

Summary

Volunteers will be recruited from the Ithaca College rowing team. Subjects will be classified by gender and level of experience. The PPI and the SIP will be administered immediately before, at the mid-point, and immediately after an intense interval workout on the Concept II rowing ergometer. Seven 2 X 2 X 3 mixed model ANOVA's (gender X experience X trial) will be used to determine if the subjects differ on PPI, COP, COG, CAT, AVD, BOD, and HURT. Post hoc tests will be administered as appropriate.

REFERENCES

Bonica, J. J. (1990). Definitions and taxonomy of pain. In J. J. Bonica (Ed.), The management of pain (Vol. 1, 2nd ed., pp. 18-27). Philadelphia: Lea & Febiger.

Chapman, C. R., & Turner, J. A. (1990). Psychological and psychosocial aspects of acute pain. In J. J. Bonica (Ed.), The management of pain (Vol. 1, 2nd ed., pp. 122-132). Philadelphia: Lea & Febiger.

Chen, D., & Singer, R. N. (1992). Self-regulation and cognitive strategies in sport participation. International Journal of Sport Psychology, 23, 277-300.

Crocker, P. R. (1992). Managing stress by competitive athletes: Ways of coping. International Journal of Sport Psychology, 23, 161-175.

Die, A. H., & Holt, V. R. (1989). Perceptions of the "typical" female, male, female athlete, and male athlete. International Journal of Sport Psychology, 20, 135-146.

Ebbling, C. B., & Clarkson, P. M. (1989). Exercise-induced skeletal muscle damage. Sports Medicine, 7, 207-234.

Feine, J. S., Bushnell, M. C., Miron, D., & Duncan, G. H. (1991). Sex differences in the perception of noxious heat stimuli. Pain, 44, 255-262.

Hall, E. G., & Davies, S. (1991). Gender differences in perceived intensity and affect of pain between athletes and nonathletes. Perceptual and Motor Skills, 73, 779-786.

Handel, P. J. (1973). Development of a social desirability and acquiescence Controlled Repression-Sensitation Scale and some preliminary validity data. Journal of Clinical Psychology, 39, 486-487.

Harris, D. V. (1981). Femininity and athleticism. In G. R. F. Luschen & G. H. Sage (Eds.), Handbook of social science and sport (pp. 274-294). Champaign: Stibes.

Hopkins, K. D., Glass, G.V., & Hopkins, B. R. (1987). Basic statistics for the behavioral sciences (2nd ed.). New Jersey: Prentice Hall.

Jaremko, M. E., Silbert, L., & Mann, M. (1981). The differential ability of athletes and nonathletes to cope with two types of pain: A radical behavioral model. Psychological Record, 31, 265-275.

Jensen, M. P., & Karoly, P. (1992). Self-report scales and procedures for assessing pain in adults. In R. Melzack & D. C. Turk (Eds.), Handbook of pain assessment (pp. 135-151). New York: Guilford.

Jensen, M. P., Turner, J. A., & Romano, J. M. (1992). Chronic pain coping measures: Individual vs. composite scores. Pain, 51, 273-280.

Lamb, D. R. (1984). Physiology of exercise responses & adaptions (2nd ed.). New York: Macmillan.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York: Springer.

Lewis, B. A. (1990). Assault on Lake Casitas. Philadelphia: Broad Street.

Lewis, L. (1992). Water's edge: Women who push the limits in rowing, kayaking & canoeing. Seattle: Seal.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. The Sport Psychologist, 1, 181-199.

McArdle, W. D., Katch, F. I., & Katch, V. L. (1986). Exercise physiology energy, nutrition, and human performance (2nd ed.). Philadelphia: Lea & Febiger.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. Pain, 30, 191-197.

Melzack, R., & Katz, J. (1992). The McGill pain questionnaire: Appraisal and current status. In R. Melzack & D. C. Turk (Eds.), Handbook of pain assessment (pp. 152-168). New York: Guilford.

Merskey, H. (1979). Pain terms: A list with definitions and notes on usage. Recommended by the IASP subcommittee on taxonomy. Pain, 6, 249-252.

Meyers, M. C., Bourgeois, A. E., LeUnes, A.D., Erick, A., & Havelka, P. (1992, October/November). Relationship between pain coping styles and athletic performance in top versus bottom-ranked athletes. Paper presented at the annual meeting of the Association for the Advancement of Applied Sport Psychology, Colorado Springs.

Meyers, M. C., Bourgeois, A. E., Stewart, S., & LeUnes, A. (1992). Predicting pain response in athletes: Development and assessment of the Sports Inventory for Pain. Journal of Sport and Exercise Psychology, 14, 249-261.

Miller, S. M., & Kirsh, N. (1987). Sex differences in cognitive coping with stress. In R. C. Barnett, L. Biener, & G. Baruch (Eds.), Gender and stress (pp. 278-307). New York: Free Press.

Mills, K. R., Newham, D. J., & Edwards, R. H. (1984). Muscle pain. In P. D. Wall & R. Melzack (Eds.), Textbook of pain (pp. 319-330). New York: Churchill Livingstone.

Morehouse, L. E., & Miller, A. T. (1963). Physiology of exercise (4th ed.). St. Louis: Mosby.

Morgan, W. P. (1973). Psychological factors influencing perceived exertion. Medicine and Science in Sports, 5, 97-103.

Morgan, W. P. (1978, April). The mind of a marathoner. Psychology Today, pp. 38-40, 43, 45-49.

Mountcastle, V. B. (1980). Pain and temperature sensibilities. In V. B. Mountcastle (Ed.), Medical physiology (Vol. 1, 4th ed., pp. 391-427). St. Louis: Mosby.

Otto, M. W., & Dougher, M. J. (1985). Sex differences and personality factors in responsivity to pain. Perceptual and Motor Skills, 61, 383-390.

Puffer, J. C., & McShane, J. M. (1992). Depression and chronic fatigue in athletes. Clinics in Sports Medicine, 11, 327-337.

Rapport, A. (1979). Pain control through hypnosis. In A. Callison (Ed.), Pain and hypnosis (pp. 219-224). New York: Academic Press.

Reed, J., Bourgeois, T., & LeUnes, A. (1992, October/November). The pain coping strategies utilized by high and low level runners. Paper presented at the annual meeting of the Association for the Advancement of Applied Sport Psychology, Colorado Springs.

Riley, J. F., Ahern, D. K., & Follick, M. J. (1988). Chronic pain and functional impairment: Assessing beliefs about their relatioships. Archives of Physical Medicine & Rehabilitation, 69, 579-582.

Rosenthiel, A. K., & Keefe, F. J. (1983). The use of coping strategies in chronic low back patients: Relationship of patient characteristics and current adjustment. Pain, 17, 33-44.

Roy, S., & Irvin, R. (1984). Sports medicine: Prevention, evaluation, management, and rehabilitation. Englewood Cliffs, NJ: Prentice-Hall.

Ryan, E. D., & Kovacic, C. R. (1966). Pain tolerance and athletic participation. Perceptual and Motor Skills, 22, 383-390.

Schwartz, D. P., DeGood, D. E., & Schutty, M. S. (1985). Direct assessment of beliefs and attitudes in chronic pain patients. Archives of Physical Medicine and Rehabilitation, 66, 806-809.

Strong, J., Ashton, R., & Chant, D. (1992). The measurement towards and beliefs about pain. Pain, 48, 227-236.

Vander, A. J., Sherman, J. H., & Luciano, D. S. (1994). Human physiology: the mechanisms of body function (6th ed.). New York: McGraw-Hill.

Walker, J. (1971). Pain and distraction in athletes and non-athletes. Perceptual and Motor Skills, 33, 1187-1190.

Wall, P. D. (1984). Introduction. In P. D. Wall & R. Melzack (Eds.), Textbook of pain (pp. 1-16). New York: Churchill Livingstone.

Whitmarsh, B. G., & Alderman, R. B. (1993). Role of psychological skills training in increasing athletic pain tolerance. The Sport Psychologist, 7, 388-399.

Williams, D. A., & Keefe, F. J. (1991). Pain beliefs and the use of cognitive-behavioral coping strategies. Pain, 46, 185-190.

Williams, D. A., & Thorn, B. E. (1989). An empirical assessment of pain beliefs. Pain, 36, 351-358.

Winborn, M. D., Meyers, A. W., & Mulling, C. (1988). The effects of gender and experience on perceived exertion. Journal of Sport and Exercise Psychology, 10, 22-31.

PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

B. S. Metz and V. L. Eskridge, Ph.D.

Ithaca College

Acknowledgements:

We wish to thank Dr. Betsy Keller for her assistance in the preparation of this manuscript, and Dr. Beth McManis for her statistical assistance.

Becky Metz

310 Second Street

Ithaca, N.Y. 14850

(607) 273-4026

May 1995

Running Head: COPING STRATEGIES

A Research Manuscript:

to be Submitted to the

Journal of Sport & Exercise Psychology

(Format: See Appendix A-8)

PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

May 1995

Abstract

Pain coping strategies of 58 novice and varsity collegiate rowers were examined. The Perceived Pain Inventory and the Sports Inventory for Pain (SIP) were administered before, during, and after an intense workout. Seven 2 X 2 X 3 (gender X experience X trial) mixed model ANOVA's were performed on the data. Significant findings ($p < 0.05$) were analyzed with post hoc tests. Results indicate that perceived pain increased for all subjects, with novice women reporting higher levels mid- and post-workout. Coping scores increased from pre- to post-workout. Cognitive scores were higher for novice rowers prior to the workout. However, when in pain their scores aligned with varsity rowers. Conclusions: a) reported coping strategies of rowers were positive, indicating a high ability to perform while in pain, and b) the introduction of exercise induced pain altered reported pain coping strategies on three of the five construct measures of the SIP. Further research is needed to establish the SIP as a useful measure of an athlete's ability to cope with pain.

Key words: exercise-induced pain, psychological coping strategies, rowing, Sports Inventory for Pain, Perceived Pain Inventory

Psychological Pain Coping Strategies in Rowers as Measured by the Sports Inventory for Pain

The phenomenon of pain is multidimensional, involving the complex interaction of physiological, neurological, biomechanical, psychological, emotional and affective dimensions. The general definition adopted by the the International Association for the Study of Pain reads: "pain: an unpleasant sensory and emotional experience associated with actual tissue damage or potential tissue damage or described in terms of such damage" (Bonica, 1990, p.18).

Pain is an integral part of athletics. Athletes are frequently exposed to two types of physiologic pain (a) traumatic pain, and (b) exercise-induced exertional pain. Traumatic pain may result in injury and usually lasts longer than pain induced by exertion. Exercise induced, exertional pain occurs during exercise and continues until the muscle contraction stops, at which point the pain dissipates. Muscle ischemia is thought to be responsible for this type of pain (Mills, Newman, & Edwards, 1984; Vander, Sherman, & Luciano, 1994). Muscle ischemia is associated with a lack of oxygen to the working muscles. It results from the inability to transport and utilize oxygen and rid the system of cardiovascular by-products. Specific training programs are designed to stress the cardiovascular system and enhance the transport and utilization of oxygen to the appropriate tissues. For athletes to become stronger, faster, and more fit, physiological limits need to be stressed, thus eliciting exertional pain. Without experiencing this pain, there is no chance to optimize performance (Walker, 1971).

Rowers are a specific group of athletes that regularly encounter exercise-induced, exertional pain during intense practices and competition. During the last part of a race, rowers are in acute pain. Their legs burn, they are short of breath, and they often feel that they are going to 'die of exhaustion'. Yet, in training they experience this pain and have learned how to cope with it.

Coping has been defined as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p. 141). In order to continue with physical activity while experiencing pain, one must react to the sensation of pain and employ psychological or behavioral coping strategies. In most cases, it is the psychological coping mechanism that is the limiting factor in the continuation of activity associated with the feeling of pain (Rapport, 1979).

Since exercise-induced, exertional pain and coping with this pain are experiences shared by all rowers, early detection and directional development, through psychological training, may improve performance at all levels. There were two purposes to this study: a) to identify pain coping strategies in rowers and b) to determine if reported pain coping strategies change when exercise-induced pain is introduced.

Methods and Procedures

Subjects

Seventy-eight female and male rowers from a Division III college crew volunteered to participate in this study. Sixteen volunteers were excluded because they could not be classified as either varsity or novice rowers. An informed consent document and a biographical data form were signed and completed by each subject prior to testing. The data from four subjects were eliminated. One subject was eliminated due to a previous injury, which prevented completion of the practice. Three subjects were eliminated due to incomplete data. Therefore, statistical analyses were performed on data from 58 subjects.

Experimental Design

All data were collected at the team boathouse during a scheduled practice. The practice consisted of an interval workout on the Concept II rowing ergometer (Concept II, Morrisville, VT). Subjects performed four sets of four 1-min pieces of rowing at maximum power on the ergometer. There was a 2-min rest following each 1-min piece, and a 5 min rest after each set of four pieces. To monitor exercise intensity and effort, heart rate and number of meters completed were recorded throughout the workout. Stroke rate was set at 31 strokes per minute (spm) ± 2 spm. The Perceived Pain Intensity (Melzack, 1987) and the Sports Inventory for Pain (Meyers, Bourgeois, Stewart, & LeUnes, 1992) were administered as a single questionnaire immediately before, at the mid point, and immediately after the interval workout.

Testing Instruments

Two tools were selected to measure perceived pain intensity and pain coping strategies. The Perceived Pain Inventory (PPI) was administered to measure perceived pain resulting from the workout and the Sports Inventory for Pain (SIP) was utilized to categorize and quantify psychological coping strategies.

Perceived Pain Inventory (PPI). Various methods of qualifying and quantifying pain are described in the literature (Jensen & Karoly, 1992;

Melzack & Katz, 1992). The McGill Pain Questionnaire (MPQ) has become the most widely used tool for the measurement of pain, primarily in the clinical setting for chronic pain. The MPQ takes 5-10 min to administer and provides feedback on both the quality and intensity of pain (Melzack, 1987). The Pain Rating Index (PRI) is the quality measure of the MPQ and is based on the rank value of selected pain descriptors (Melzack & Katz, 1992). The Perceived Pain Inventory (PPI) represents the intensity measure and was the only portion of the MPQ that was utilized in this study.

The PPI is a self-report written scale consisting of five number-word pain descriptives ranging from 0 (none) to 5 (excruciating) (Melzack, 1987). The number selected on the PPI represents the subject's perceived pain at a given point in time. Each subject had one PPI score for each of three test administrations.

Sports Inventory for Pain (SIP). There are a number of tools that identify attitudes, beliefs, and coping strategies in chronic pain patients (Strong, Ashton, & Chant, 1991; Williams & Keefe, 1991; Williams & Thorne, 1989; Schwartz, DeGood, & Schutty, 1985; Rosenthiel & Keefe, 1983). The Sports Inventory for Pain (SIP) is a relatively new tool designed to identify attitudes toward pain and psychological coping strategies specifically in athletes (Meyers, Bourgeois, Stewart, & LeUnes, 1992). Currently the SIP is the only such tool designed for measuring pain incurred during sport participation. The statements that comprise the SIP are all sport situational and approximately half of these statements relate specifically to athletic injury and pain associated with injury. Meyers, Bourgeois, Stewart, and LeUnes (1992) allude that the SIP may be a beneficial predictor for athletic performance and adherence to exercise programs. However, enduring pain due to injury, as they suggest, and enduring pain due to exertion, are two different experiences the athlete may potentially face.

The SIP is a written questionnaire consisting of 25 statements that represent five coping constructs: coping (COP), cognitive (COG), catastrophizing (CAT), avoidance (AVD), and body awareness (BOD). Each statement is followed by a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Meyers, Bourgeois, Stewart, &LeUnes, 1992). Construct scores were calculated by summing the scores from the appropriate statements for each subject. There is a sixth category HURT, which is the composite score of the SIP. The HURT score was calculated by adding the scores from the positive constructs COP and COG, and subtracting the scores from the negative constructs, CAT and AVD (HURT = COP + COG - CAT - AVD). Collapsing the data resulted in 18 scores for each subject; six scores (COP, COG, CAT, AVD, BOD, HURT) for each of the three administrations of the SIP.

Statistical Design

Seven 2 X 2 X 3 (gender X experience X trial) mixed model analyses of variance (ANOVA) were performed on the raw scores of the PPI and the construct scores (COP, COG, CAT, AVD, BOD, and HURT). The .05 level of significance was established as acceptable for rejecting the null hypotheses. Statistical analyses were performed using the SPSS-X computer program. Tukey post-hoc tests were performed on the significant main effects. Simple effect analyses and Dunn-Bonferroni post-hoc tests were performed on significant interactions.

Results

Descriptive Characteristics

The subject pool (N = 58) consisted of 11 varsity women, 16 varsity men, 13 novice women, and 18 novice men ranging in age from 18 - 22 years. Descriptive characteristics (see Table 1) were (standard deviations in parenthesis): age, $\underline{M}$ = 19.54 (1.21); years of rowing experience $\underline{M}$ = 2.14 (1.31); years of athletic experience $\underline{M}$ = 6.13 (2.74).

Insert Table 1 about here

Perceived Pain Inventory (PPI)

Perceived pain, as measured by the PPI, increased significantly ($F_{(2, 108)}$ = 124.01, p = .000) from pre-workout ($\underline{M}$ = .10) to mid-workout ($\underline{M}$ = 1.66) ($q_{(3,55)}$ = 20.23, $p < .05$) and from mid-workout to post-workout ($\underline{M}$ = 2.02) ($q_{(3,55)}$ = 3.85, $p < .05$) for all subjects.

In addition, a significant interaction (gender X experience X trial) was found for PPI ($F_{2, 108)}$ = 4.87, p = .009). Both the interacton and the trial comparisons (pre, mid, post), described below, are illustrated in Figure 1.

Insert Figure 1 about here

On the pre-workout administration of the PPI, no significant differences existed among the gender or experience levels of the subjects.

On the mid-workout administration, no significant differences existed between the PPI scores of varsity women (M = 1.18) and varsity men (M = 1.13) ($F_{(1, 25)} = .21$, $p = .649$), or between varsity men (M = 1.13) and novice men (M = 1.44) ($F_{(1, 32)} = .16$, $p = .694$). The novice women's PPI score (M = 2.77) was significantly greater than the other comparison groups ($F_{(1, 22)} = 20.72$, $p = .000$) ($F_{(1, 29)} = 11.73$, $p = .002$).

On the post-workout administration of the PPI, a pattern similar to that of the mid-workout was seen. No significant differences existed between varsity women (M = 1.55) and varsity men (M = 1.81) ($F_{(1, 25)} = .50$, $p = .485$) or between varsity men (M = 1.81) and novice men (M = 1.83) ($F_{(1, 32)} = .00$, $p = .955$). The PPI score for the novice women (M = 2.92) was significantly greater than the PPI score of the other comparison groups ($F_{(1, 22)} = 12.66$, $p = .002$) ($F_{(1, 29)} = 7.78$, $p = .009$).

Sports Inventory for Pain (SIP)

The SIP was divided into five constructs (COP, COG, CAT, AVD, BOD) and one composite construct (HURT) for comparisons across trials, between gender, and among levels of experience. Separate mixed model ANOVA's were performed for each construct. Table 2 summarizes a profile of scores for the constructs of the SIP for each of the subject sub-groups at the pre-, mid-, and post-workout. Rowers scored in the 69th percentile for COP, the 59th percentile for COG, the 44th percentile for CAT, the 50th percentile for AVD, and the 57th percentile for BOD. The 50th percentile reflects neutral responses on the SIP.

Insert Table 2 about here

Coping Construct (COP). The interaction (gender X experience X trial) for the reported COP construct approached significance ($F_{(2, 108)} = 2.85$, $p = .062$). There was a significant trial main effect ($F_{(2, 108)} = 3.06$, $p = .051$) shown in figure 2. Tukey's post-hoc tests were performed. Although there was a trend for COP to increase successively over each trial, the only significant difference existed between the pre-workout COP score ($\underline{M} = 29.7$), which was lower than the post-workout COP score ($\underline{M} = 30.8$) ($q_{(3, 55)} = 3.50$, $p < .05$).

Insert Figure 2 about here

Cognitive Construct (COG). The gender X experience X trial interaction on the COG construct was not significant ($F_{(2, 108)} = .81$, $p = .448$). However, the experience X trial interaction was significant ($F_{(2, 108)} = 3.37$, $p = .038$). Simple effects analyses indicated that the only significant difference was on the pre-workout administration of the SIP (see Figure 3). At this administration COG score for novice rowers ($\underline{M} = 17.7$) was significantly greater than that of the varsity rowers ($\underline{M} = 15.7$) ($F_{(1, 162)} = 5.12$, $p < .05$). There were no significant differences between men and women (gender X trial) ($F_{(2, 108)} = .20$, $p = .816$) or across trials ($F_{(2, 108)} = .40$, $p = .671$).

Insert Figure 3 about here

Catastrophizing Construct (CAT). There was no significant (gender X experience X trial) interaction for CAT ($F_{(2, 108)} = .85$, $p = .429$). The gender, experience, or trial main effects were not significant.

Avoidance Construct (AVD). There was no significant (gender X experience X trial) interaction for AVD ($F_{(2, 108)} = .00$, $p = .996$). There was a significant (gender X experience) interaction ($F_{(1, 54)} = 7.31$, $p = .009$). However, the Dunn-Bonferroni post-hoc tests did not yield any significant differences. The main effects for gender, experience level, or trial for the AVD scores were not significant.

Body Awareness Construct (BOD). The gender X experience X trial interaction for BOD ($F_{(2, 108)} = .67$, $p = .512$) was not significant. However, there were significant gender ($F_{(1, 54)} = 7.37$, $p = .009$), and experience level ($F_{(1, 54)} = 4.35$, $p = .042$) main effects (see Figure 4). Simple effect analyses indicated that significant differences occurred on the mid-workout administration of the SIP. At this administration, BOD score for men ($\underline{M} = 13.86$) was significantly higher than that of women ($\underline{M} = 11.31$) ($F_{(1, 162)} = 9.17$, $p < .05$) and the BOD score for novice ($\underline{M} = 13.45$) was significantly higher than that of varsity ($\underline{M} = 11.73$) ($F_{(1, 162)} = 5.34$, $p < .05$). The trial main effect for BOD was not significant ($F_{(1, 54)} = 1.01$, $p = .367$).

Insert Figure 4 about here

Composite Index (HURT). The gender X experience X trial interaction for the HURT index was not significant ($F_{(2, 108)} = 1.93$, $p = .150$). The gender, experience, or trial main effects were not significant.

Discussion

Rowers need to endure certain levels of exercise-induced pain. Thus, it was hypothesized that rowers would be more likely to agree with the statements comprising the coping constructs that are considered positive and would be less likely to agree with the statements comprising the coping constructs that are considered negative. This would be reflected in high COP and COG scores and a low CAT and AVD scores relative to a neutral response. In addition, the composite HURT value, which is derived by subtracting the negative subscales from the positive subscales (HURT= COP + COG - CAT - AVD) would be high. Theoretically, HURT is a measure of an athlete's ability to perform while in pain. The greater the HURT value, the greater the ability to cope and withstand pain. The profile of pain coping strategies demonstrated by rowers in this study supported the hypothesis. This profile would be expected in athletes who regularly experience exercise-induced pain during practice and competition. Further studies are needed to compare different athlete groups to ascertain if all athletes demonstrate a similar profile, or if this profile is unique to rowers.

In order to verify that the experimental tool was administered to subjects both while they were in pain and pain free, the PPI was administered with the SIP. It was hypothesized that an increase in perceived exercise-induced pain would occur during an intense interval workout on the rowing ergometer. Statistical results supported this hypothesis. PPI values increased consistently from pre-workout to post-workout.

Rowers, regardless of gender or experience level, reported little or no perceived pain on the pre-workout administration of the PPI. This is an appropriate finding for healthy, non-injured athletes prior to a workout.

Novice women reported higher perceived pain levels than all other groups when exercise-induced pain was present. It is interesting to note that the varsity women responded similarly to that of the men, both novice and varsity. These results are consistent with other research. A compilation of the literature, specific to perceived pain intensity and the pain experience (Hall & Davies, 1991; Mahoney, Gabriel, & Perkins, 1987; Ryan & Koviak, 1966; Walker, 1971), indicates that male athletes, male non-athletes and female athletes are similar in their reports of perceived pain. Female non-athletes, like the novice women in this study, differ from all three groups by reporting higher levels of perceived pain. Novice women differed from novice men, in spite of having similar number of years rowing and general athletic experience. Thus, experience alone may not account for the higher perceived pain reported by the novice women. Something in the advanced rowing experience appears to change the reaction of female rowers to pain, such that their reports of perceived pain are more similar to that of males. These findings support the theory that females, especially female athletes, may follow a different set of social learning factors than their male counterparts. Longitudinal studies are needed to ascertain if there is actually a change in the way individuals report levels of perceived pain as they progress from novice to varsity, or if those individuals who report high levels of perceived pain quit before reaching varsity level.

It is obvious that the absence or presence of exercise-induced pain should not affect the way one responds to SIP questionnaire if it is to be useful in predicting pain coping responses during exercise. It was hypothesized that no change on any of the SIP construct scores would hypothesized that no change on any of the SIP construct scores would occur from pre- to mid- to post-workout, regardless of gender or experience level.

No significant differences were found in any of the comparisons using the HURT value, which supports this hypothesis. However, since the HURT value is the melding of four distinct constructs, each of the constructs that contributes to the HURT value must be individually analyzed before this hypothesis can be fully accepted.

The CAT and the AVD were the negative contributers to the HURT formula. The CAT construct was designed to measure catastrophizing responses. This is described as the tendency of the individual to be overwhelmed by pain-producing stimuli. The AVD construct was designed to measure avoidance responses. This is the tendency for an individual to avoid pain-producing stimuli. No differences were found for either of these negative constructs. Thus, like the HURT, the CAT and the AVD constructs may be useful in predicting coping responses during exercise-induced pain experiences.

In contrast, differences in both positive constructs, COP and COG, were found. Initially, the COP construct was described by Meyers, Bourgeois, Stewart, and LeUnes, 1992, as a measure of direct coping responses and the COG construct as a measure of cognitive responses, which are the higher order mental procedures that lead to psychological coping. However, upon scrutiny, the statements comprising the COP, appear to focus on completing the physical task despite the pain (e.g., I owe it to myself and those around me to compete even when my pain is bad). Whereas, those comprising the COG appear to focus on reducing the

In the current study, all rowers scored high on the COP construct and scored even higher as the exercise-induced pain increased. These results indicate that rowers tend to focus on the task despite the pain and this tendency increases as the exercise-induced pain increases.

Similar to the other positive construct, differences within the COG were found. Prior to the presence of exercise-induced pain, novice rowers, regardless of gender, reported higher COG construct scores than the varsity rowers. Possibly, this occurred due to the "ignorance is bliss" phenomenon. For the novice rowers this was their first experience with this type of a workout. Without previous experience they did not know what to expect and overestimated the use of distracting thoughts to reduce the pain. The varsity rowers, on the other hand, had experienced this type of exercise-induced pain. Accordingly, after the initial trial and the onset of this pain, the experience level groups aligned and reported similar cognitive construct scores. It appears that administering the SIP when rowers are not in pain will not predict the full extent of their responses, at least on the constructs that are considered positive, when they are experiencing pain.

The BOD construct was designed to measure the experimental phenomenon of the tendency for an individual to psychologically distort responses to pain stimulus on self report measures. It is designed to measure the extent that an individual is hypersensitive or hyposensitive to physiologically produced sensory stimuli. The BOD construct is considered neither a negative nor a positive coping strategy (Meyers, Bourgeois, Stewart, & LeUnes, 1992).

There was a gender and experience level difference for BOD scores on the mid-workout administration. Males scored higher than females, which is in agreement with other studies that used the SIP for gender comparisons (Meyers, Bourgeois, LeUnes, & Havelka, 1992; Meyers, Bourgeois, Stewart, & LeUnes, 1992; Reed, Bourgeois, & LeUnes, 1992) and novice scored higher than varsity. A high score on the BOD reflects hyposensitivity, while a low score on the BOD coincides with hypersensitivity to pain producing stimuli. Since the validity of the BOD construct has not been verified, scores were collected and analyzed, but no conclusions were drawn.

It was concluded from this study that: a) rowers reported a pain coping profile that was positive, indicating a high ability to perform while in pain and b) the introduction of exercise-induced pain altered reported pain coping strategies on three of the five construct measures of the Sports Inventory for Pain.

Due to the variability of the scores within the COG, COP, and BOD constructs, the reliability and the predictability of the SIP has not been verified and, therefore, should be used with caution, especially on subjects that are not experiencing pain. It is interesting to note that the athletes utilized in the development of the tool were experiencing pain due to injury. In contrast, the rowers who participated in this study were experiencing exercise-induced pain, which they knew would dissipate at the completion of the task. Further studies, involving subjects who are both in pain and pain free, are needed to establish the SIP as a useful measure of an athlete's ability to cope with pain.

References

Bonica, J. J. (1990). Definitions and taxonomy of pain. In J. J. Bonica (Ed.), The management of pain (Vol. 1, 2nd ed., pp. 18-27). Philadelphia: Lea & Febiger.

Hall, E. G., & Davies, S. (1991). Gender differences in perceived intensity and affect of pain between athletes and nonathletes. Perceptual and Motor Skills, 73, 779-786.

Jensen, M. P., & Karoly, P. (1992). Self-report scales and procedures for assessing pain in adults. In R. Melzack & D. C. Turk (Eds.), Handbook of pain assessment (pp. 135-151). New York: Guilford.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. New York: Springer.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. The Sport Psychologist, 1, 181-199.

Melzack, R. (1987). The short-form McGill Pain Questionnaire. Pain, 30, 191-197.

Melzack, R., & Katz, J. (1992). The McGill pain questionnaire: Appraisal and current status. In R. Melzack & D. C. Turk (Eds.), Handbook of pain assessment (pp. 152-168). New York: Guilford.

Meyers, M. C., Bourgeois, A. E., LeUnes, A.D., Erick, A., & Havelka, P. (1992, October/November). Relationship between pain coping styles and athletic performance in top versus bottom-ranked athletes. Paper presented at the annual meeting of the Association for the Advancement of Applied Sport Psychology, Colorado Springs.

Meyers, M. C., Bourgeois, A. E., Stewart, S., & LeUnes, A. (1992). Predicting pain response in athletes: Development and assessment of the Sports Inventory for Pain. Journal of Sport and Exercise Psychology, 14, 249-261.

Mills, K. R., Newham, D. J., & Edwards, R. H. (1984). Muscle pain. In P. D. Wall & R. Melzack (Eds.), Textbook of pain (pp. 319-330). New York: Churchill Livingstone.

Rapport, A. (1979). Pain control through hypnosis. In A. Callison (Ed.), Pain and hypnosis (pp. 219-224). New York: Academic Press.

Reed, J., Bourgeois, T., & LeUnes, A. (1992, October/November). The pain coping strategies utilized by high and low level runners. Paper presented at the annual meeting of the Association for the Advancement of Applied Sport Psychology, Colorado Springs.

Rosenthiel, A. K., & Keefe, F. J. (1983). The use of coping strategies in chronic low back patients: Relationship of patient characteristics and current adjustment. Pain, 17, 33-44.

Ryan, E. D., & Kovacic, C. R. (1966). Pain tolerance and athletic participation. Perceptual and Motor Skills, 22, 383-390.

Schwartz, D. P., DeGood, D. E., & Schutty, M. S. (1985). Direct assessment of beliefs and attitudes in chronic pain patients. Archives of Physical Medicine and Rehabilitation, 66, 806-809.

Strong, J., Ashton, R., & Chant, D. (1992). The measurement towards and beliefs about pain. Pain, 48, 227-236.

Vander, A. J., Sherman, J. H., & Luciano, D. S. (1994). Human physiology: the mechanisms of body function (6th ed.). New York: McGraw-Hill.

Walker, J. (1971). Pain and distraction in athletes and non-athletes. Perceptual and Motor Skills, 33, 1187-1190.

training in increasing athletic pain tolerance. The Sport Psychologist, 7, 388-399.

Williams, D. A., & Keefe, F. J. (1991). Pain beliefs and the use of cognitive behavioral coping strategies. Pain, 46, 185-190.

Williams, D. A., & Thorn, B. E. (1989). An empirical assessment of pain beliefs. Pain, 36, 351-358.

Table 1

Descripitive Characteristics for Age, Years of Rowing Experience, and Years of Athletic Experience

	Age	Years of Rowing Experience	Years of Athletic Experience
All Subjects (N=58)			
Mean (SD)	19.54 (1.21)	2.41 (1.31)	6.13 (2.74)
Range	18-22	1-8	1-14
Novice Women (N=13)			
Mean (SD)	18.54 (.66)	1.00 (.00)	5.58 (1.93)
Range	18-20	1-1	2-9
Varsity Women (N=11)			
Mean (SD)	20.36 (.50)	3.27 (.65)	7.18 (2.89)
Range	20-21	3-5	3-14
Novice Men (N=18)			
Mean (SD)	18.75 (.97)	1.00 (.00)	5.25 (2.94)
Range	18-21	1-1	1-13
Varsity Men (N=16)			
Mean (SD)	20.33 (1.24)	3.72 (1.27)	6.88 (2.29)
Range	18-22	3-8	3-14

Table 2

Profile of Rowers on the Construct Scores of the Sports Inventory for Pain

		COP	COG	CAT	AVD	BOD	HURT
Pre-workout							
Rowers	M	29.72	16.83*	11.07	12.09	13.19	23.37
	SD	(4.19)	(3.11)	(2.91)	(2.85)	(3.02)	(7.73)
Experience							
Novice	M(SD)		16.82 (3.40)				
Varsity	M(SD)		15.88 (3.15)				
Mid-workout							
Rowers	M	29.98	16.74	11.03	11.95	12.88*	23.74
	SD	(4.25)	(3.33)	(2.92)	(2.79)	(3.20)	(8.35)
Experience							
Novice	M(SD)					13.45 (2.94)	
Varsity	M(SD)					11.73 (2.79)	
Gender							
Women	M(SD)					11.310 (2.90)	
Men	M(SD)					13.861 (2.83)	
Post-workout							
Rowers	M	30.85	17.00	11.21	11.90	13.24	24.83
SD		(4.11)	(3.45)	(2.46)	(2.83)	(3.06)	(8.13)

* Indicates a significant difference within the construct. Means and standard deviations are reported where differences occur.

Figure Captions

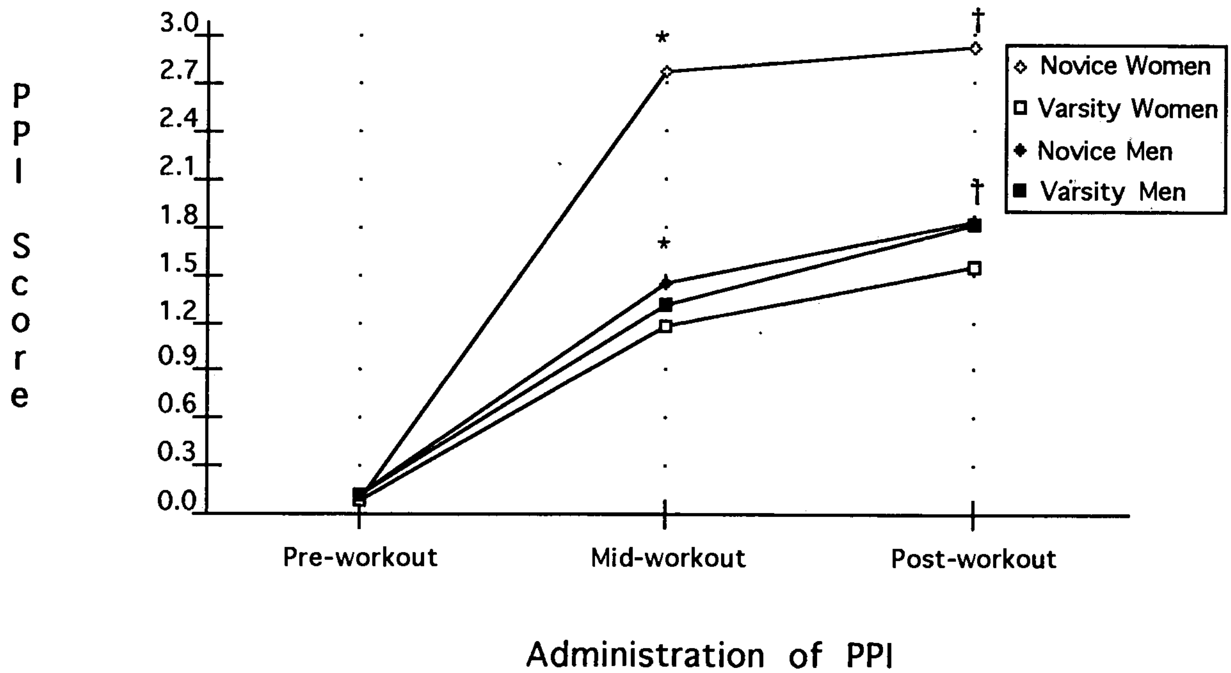
Figure 1. Comparison of Perceived Pain Inventory (PPI) means for the gender/experience rower sub-groups at each test administration.
* $p < 0.05$, † $p < 0.05$

Figure 2. Comparison of Coping (COP) construct means for all rowers at each administration of the Sports Inventory for Pain (SIP). * $p < 0.05$

Figure 3. Comparison of Cognitive (COG) construct means for novice and varsity rowers at each administration of the Sports Inventory for Pain (SIP). * $p < 0.05$

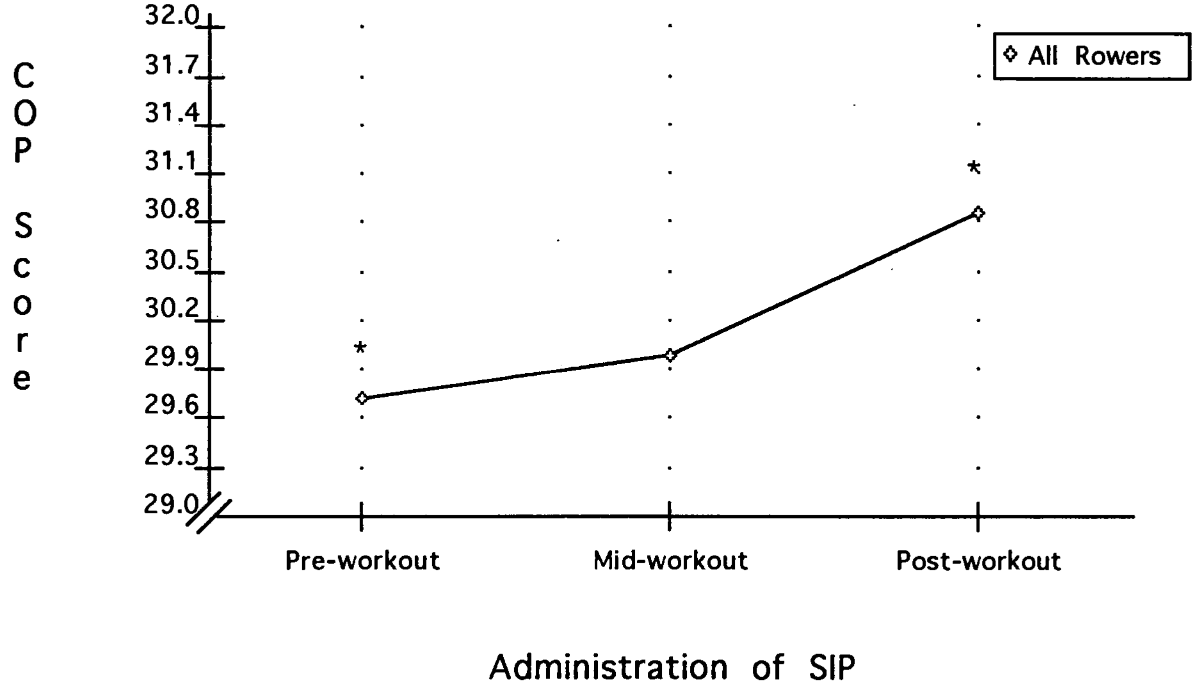
Figure 4. Comparison of Body Awareness (BOD) construct means for gender (women vs. men) and experience level (novice vs. varsity) at each administration of the Sports Inventory for Pain (SIP). * $p < 0.05$, † $p < 0.05$

Figure 1.



PPI Score
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
0.6
0.3
0.0
*
*
†
†
Novice Women
Varsity Women
Novice Men
Varsity Men
Pre-workout
Mid-workout
Post-workout
Administration of PPI

Figure 2.


C O P Score
32.0
31.7
31.4
31.1
30.8
30.5
30.2
29.9
29.6
29.3
29.0
All Rowers
*
*
Pre-workout
Mid-workout
Post-workout
Administration of SIP

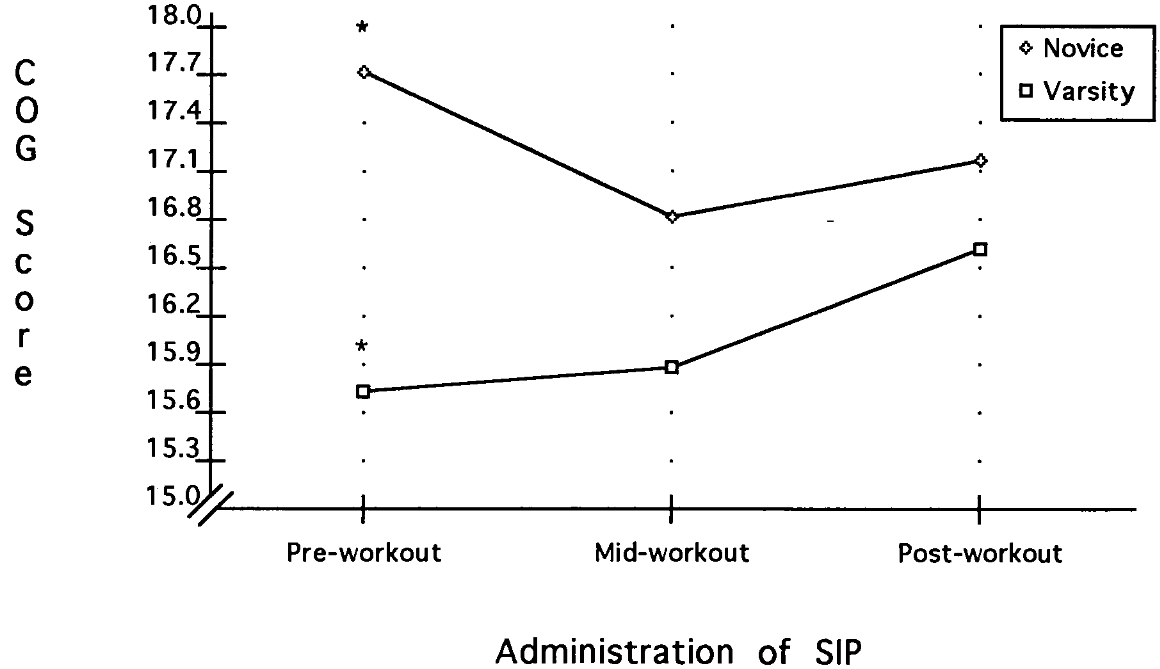
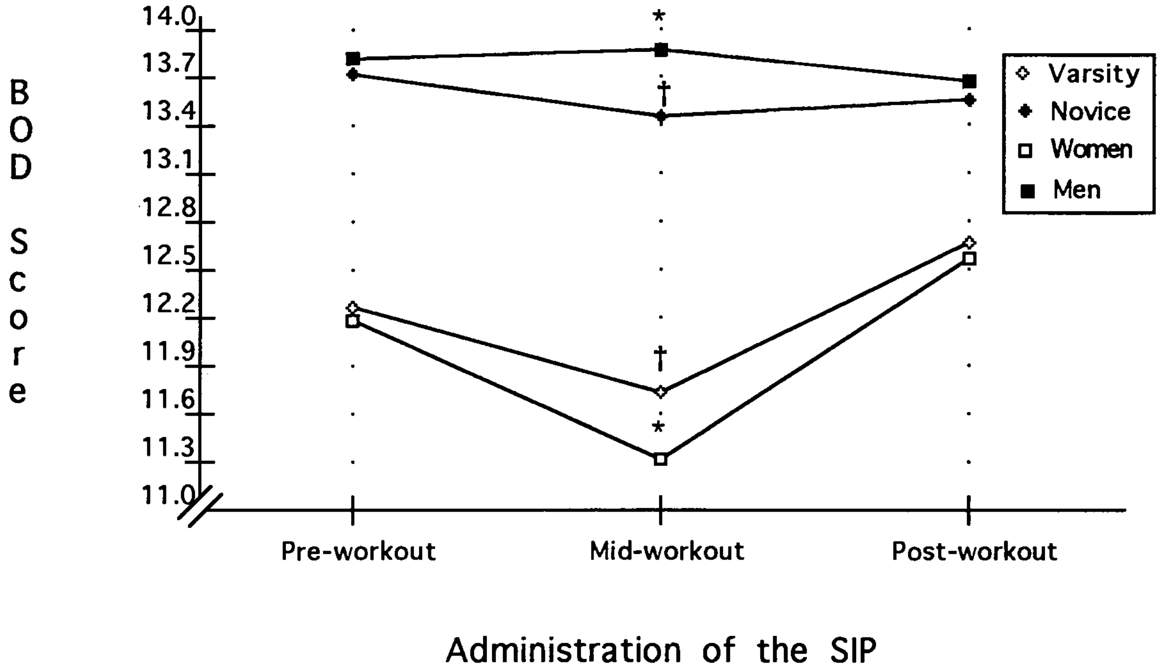

COG Score
18.0
17.7
17.4
17.1
16.8
16.5
16.2
15.9
15.6
15.3
15.0
*
*
Novice
Varsity
Pre-workout
Mid-workout
Post-workout
Administration of SIP

Figure 4.


BOD Score
14.0
13.7
13.4
13.1
12.8
12.5
12.2
11.9
11.6
11.3
11.0
Varsity
Novice
Women
Men
Pre-workout
Mid-workout
Post-workout
Administration of the SIP

Appendix A

APPENDICES FOR THE PROPOSAL AND THE MANUSCRIPT: PSYCHOLOGICAL COPING STRATEGIES IN ROWERS AS MEASURED BY THE SPORTS INVENTORY FOR PAIN

Appendix A-1

RECRUITMENT FLYER

SUBJECTS NEEDED

WHO: Any Ithaca College Crew member. Men and women, varsity and novice rowers are needed.

WHAT FOR: To take part in a study that attempts to identify pain coping strategies in rowers as measured by the Sports Inventory of Pain Questionnaire.

WHEN: During a scheduled interval workout on the Concept II Rowing Ergometer.

WHERE: At Haskell Davidson Boathouse.

You will be asked to answer a 25-item questionnaire before, during, and after your scheduled workout. The questionnaire identifies pain coping strategies in athletes. No additional workout will be required.

If you are interested please sign below. If you would like more information or have questions contact Becky Metz at 273-4026.

Name	Phone	Name	Phone

Appendix A-2

PERCEIVED PAIN INVENTORY

PPI

0	NO PAIN	_____
1	MILD	_____
2	DISCOMFORTING	_____
3	DISTRESSING	_____
4	HORRIBLE	_____
5	EXCRUCIATING	_____

ITHACA

Ithaca College
Celebration
of a Century
1892-1992

953 Danby Road
Ithaca College
Ithaca, New York 14850

School of Health Sciences
and Human Performance
Department of Exercise
and Sport Sciences
607-274-3189

December 15, 1992

Dr. R. Melzack
Dept. of Psychology
McGill University
1205 Dr. Penfield Ave.
Montreal, Quebec
Canada H3A1B1

Dear Dr. Melzack:

Several researchers here at Ithaca College are involved in designing studies which will begin data collection in late December, 1992, and early January, 1993. Two of us are particularly interested in measuring various aspects of acute, exercise specific pain. V. L. Eskridge, Ph.D., is planning on using the Sports Inventory of Pain Questionnaire (SIP) (Meyers, et al., 1992) and the Pain Beliefs and Perceptions Inventory (PBAPI) (Williams & Thorn, 1989) to study long term exercise compliance in individuals over the age of 65 years. Becky Metz, Graduate Assistant, will be using the same instruments to study pain attitudes in collegiate rowers for her thesis. We both would like to add the sensory descriptors and the Present Pain Intensity (PPI) scales from the Short Form McGill Pain Questionnaire to our data collection tools for these studies.

We understand, after talking with you by phone, that a copyright release from you would be appropriate. Toward that end we are submitting two copies for your signature and return in the self-addressed, stamped envelope for our files.

We are planning on professionally disseminating the results of our research, but would be willing to share the data from the McGill Questionnaire with you if you are interested.

Thank you in advance for your assistance in this matter.

Sincerely,

V. L. Eskridge, Ph.D.

Becky Metz
Becky Metz, Graduate Assistant

Signature indicating copyright release of the short-form of the McGill Pain Questionnaire for use in research conducted by the authors of this letter.

Signature Ronald Melzack Date Jan 5, 1993

Appendix A-3

SPORTS INVENTORY FOR PAIN

Below is a list of statements that describe the way athletes often feel about pain and it's influence on competition. Please take your time and read each statement carefully, so that we may find out how you feel toward pain. Then fill in one circle to the right of each statement that best describes your feelings at this time. Please answer honestly. There are no right or wrong answers.

Strongly Disagree = SD
Disagree = D
Neutral = N
Agree = A
Strongly Agree = SA

	SD	D	N	A	SA
1. I see pain as a challenge and don't let it bother me.	0	0	0	0	0
2. I owe it to myself and those around me to compete even when my pain is bad.	0	0	0	0	0
3. When in pain, I tell myself it doesn't hurt.	0	0	0	0	0
4. When injured I pray for the pain to stop.	0	0	0	0	0
5. If I feel pain during athletic activity, it's probably a sign that I'm doing damage to my body.	0	0	0	0	0
6. I have little or no trouble with my muscles twitching or jumping.	0	0	0	0	0
7. At this point, I am more interested in returning to athletic competition than in trying to stop this pain.	0	0	0	0	0
8. When in pain, I imagine that the pain is outside my body.	0	0	0	0	0
9. My pain is terrible and I feel it is never going to get better.	0	0	0	0	0
10. I could perform as well as ever if my pain would go away.	0	0	0	0	0

	SD	D	N	A	SA
11. I do not worry about being injured.	0	0	0	0	0
12. Pain is just part of competition.	0	0	0	0	0
13. When hurt, I play mental games with myself to keep my mind off the pain.	0	0	0	0	0
14. When in pain, I worry all the time about whether it will end.	0	0	0	0	0
15. I have to be careful not to make my pain worse.	0	0	0	0	0
16. I seldom or never have dizzy spells or headaches.	0	0	0	0	0
17. When I am hurt, I just go on as if nothing has happened.	0	0	0	0	0
18. When in pain, I replay in my mind pleasant athletic experiences from my past.	0	0	0	0	0
19. If in pain, I often feel I can't stand it anymore.	0	0	0	0	0
20. The worse thing that could happen to me is to injure/reinjure myself.	0	0	0	0	0
21. I seldom notice minor injuries.	0	0	0	0	0
22. When injured, I tell myself to be tough and carry out despite the pain.	0	0	0	0	0
23. When hurt, I do anything to get my mind off the pain.	0	0	0	0	0
24. When hurt, I tell myself I can't let the pain stand in the way of what I want to do.	0	0	0	0	0
25. No matter how bad the pain gets, I know I can handle it.	0	0	0	0	0

KSU
KANSAS STATE UNIVERSITY

Center for Exercise Research

8 Natatorium
Ahearn Field House
Manhattan, Kansas 66506-0308
913-532-6765

November 12, 1992

Becky Metz
985 Taughannock Blvd
Ithaca, NY 14850

Dear Becky,

Thanks for your inquiry concerning the Sports Inventory for Pain (SIP). As requested, I have enclosed:

1. SIP handout (scoring procedure, subscale information, biodata/subject consent form, t-score normative table, sample test & key)

2. Manuscript entitled "Predicting pain response in athletes: Development and assessment of the Sports Inventory for Pain", Journal of Sport and Exercise, 14, 249-261.

3. Abstracts presented at the Association for the Advancement of Applied Sports Psychology Conference, Colorado Springs, CO, 1992.

At the present time, our research efforts are continuing to focus on construct validity, as well as further demonstrating utility in applied situations across various sports, age levels, and levels of sport competition. Present sport populations include ultramarathon, rodeo, lacrosse, exercise/aerobics, equestrian, volleyball, weightlifting, and running (n=700+).

I anticipate that the SIP will be useful among physicians and athletic trainers (preventative medicine), coaches and scouts (personnel involved in athletic selection), sport psychologists (for psychological enhancement/intervention), and physical therapists (rehabilitation setting).

If you need further information or have additional comments or concerns, please contact me. Looking forward to collaborating on some studies in the future. Thank you.

Sincerely,

Michael C. Meyers, PhD

Appendix A-4

INFORMATIONAL SHEET

1. Purpose of the study
The purpose of this study is to determine your attitudes toward the pain you feel during one of your normal workout sessions.

3. What you will be asked to do
This study will take 15-20 minutes of your time during a scheduled interval workout on the Concept II Rowing Ergometer. You will be asked to fill out a 25-item questionnaire and rate your perceived pain before, during, and after your workout.

Before your workout, you will be asked to confidentially complete a biographical data form and answer the Sports Inventory for Pain Questionnaire (SIP). There are no right or wrong answers for the SIP.

During the interval practice your heart rate and number of meters completed will be recorded after each piece. Half-way through practice, during a rest period, you will be given the SIP questionnaire again.

Immediately following the completion of the workout you will be given the SIP questionnaire for the last time.

4. Requirements
To participate in this study you must be 18 years of age or older.

5. Withdrawl from the Study
You will be free to withdraw from the study at any time. Your athletic and/or academic status will in no way be affected by your participation or non-participation in this study.

6. If You Would Like More Information About the Study
If you have any questions or would like more information about this study contact Becky Metz, 310 Second Street, Ithaca, 273-4026.

Please tear this sheet off and keep it if you would like to participate in this study.

Appendix A-5

BIOGRAPHICAL DATA FORM

A) Date:______________

B) Your Age:__________

C) Gender: M F (circle one)

D) Class: FR SO JR SR GRADUATE (circle one)

E) Years as a competitive rower:_______________ (actual #)

F) Position or Event:___________________ (Hwt, Lwt, 8+, 4+)

G) Team Level 1) Varsity 3) Novice
(circle one) 2) Junior Varsity 4) National/Amateur

H) Other organized athletic teams you participated in during highschool or college:____

I) How many years have you competed on these athletic teams?______

J) How many injuries have you experienced while competing on these teams? _______

K) To what extent has injury tended to interfere with your athletic participation, exercise or rehabilitation? (1=none, 4=moderate, 7=prevents participation)
(circle one) 1 2 3 4 5 6 7

L) Are you currently injured? Yes No (circle one)

M) Do you have permission from a physician, coach, athletic trainer ect. to participate in athletic activities now.
Yes No (circle one)

Appendix A-6

WORKOUT RECORD SHEET

1) First administration of the SIP and PPI.

2) SET 1

Piece	Meters	HR
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____

3) 5 minutes rest.

4) Set 2

Piece	Meters	HR
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____

5) 5 minutes rest.
Second administration of the SIP and PPI.

6) SET 3

Piece	Meters	HR
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____

7) 5 minutes rest.

8) Set 4

Piece	Meters	HR
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____
1min.	_______	_____

9) Last administration of the SIP and PPI.

Appendix A-7

SUBSCALES AND RESPECTIVE STATEMENTS FOR
THE SPORTS INVENTORY FOR PAIN

Construct	Statements
Coping (COP)	#1, #2, #7, #12, #17, #22, #24, #25
Cognitive (COG)	#3, #8, #13, #18, #23
Catastrophizing (CAT)	#4, #9, #14, #19
Avoidance (AVD)	#5, #10, #15, #20
Body Awareness (BOD)	#6, #11, #16, #21

Appendix A-8

INSTRUCTIONS TO CONTRIBUTERS

In preparing manuscripts for publication in the *Journal of Sport & Exercise Psychology*, authors should adhere to the guidelines provided in the *Publication Manual of the American Psychological Association*, third edition, 1983. Copies of this manual are found in most university libraries or may be obtained through the order department, American Psychological Association, P.O. Box 2710, Hyattsville, MD 20784-0710. All articles must be preceded by an abstract of 100-150 words typed on a separate page. Special attention should be given to the preparation and accuracy of references. The manuscript must be double-spaced including the abstract, references, and all tables. All figures must be professionally prepared and camera-ready: freehand and typewritten lettering will not be accepted. Also, all manuscripts are subject to editing for sexist language.

Submit four copies of the manuscript to the editor, W. Jack Rejeski, Dept. of Health & Sport Science. Wake Forest University, Winston-Salem, NC 27109. All copies should be clear, readable, and on paper of good quality. A dot matrix or unusual typeface is acceptable only if it is clear and legible. Dittoed and mimeographed copies will not be considered. Manuscripts should not be submitted to another journal at the same time. Authors are advised to check carefully the typing of the final copy and to retain a copy of the manuscript to guard against loss. Manuscripts will not be returned to the authors. Manuscripts are read by two reviewers, with the review process taking 8 to 10 weeks. There are no page charges to the contributers. Authors of manuscripts accepted for publication must transfer copyright to Human Kinetics Publishers, Inc.

A blind review process is used to evaluate the manuscripts. With each copy of the manuscript, authors are requested to submit a separate cover sheet including the title of the manuscript, name of the author(s), institutional affiliation(s), running head, date of the manuscript submission, and full mailing address and telephone number of the author who is to receive the galley proofs. The first page of the manuscript should omit the author's name and affiliation but include the title of the manuscript and the date of submission. Footnotes that identify the author should be typed on a separate page. Every effort should be made to see that the manuscript itself contains no clues to the author's identity.

Review articles and experimental/methodological studies should not exceed 28 pages (including references, tables, figures, ect.): brief reports are limited to 7 pages. Particular attention should be given to condensing research reports as much as possible. Research reports will be judged on their topical relevance, methodological adequacy, and clarity of reporting. Authors are expected to have their raw data and descriptive statistics available throughout the editorial review process and are responsible for providing elaboration upon request.

Appendix B

STATISTICAL TABLES FOR THE PERCEIVED PAIN INVENTORY

Appendix B-1

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR PERCEIVED PAIN INTENSITY

	Perceived Pain Inventory				
Source	SS	df	MS	F	p
Between Subjects	56.41	54	1.04		
Gender	4.43	1	4.43	4.24	.004*
Experience	11.13	1	11.13	10.66	.002*
Gender X Experience	9.22	1	9.22	8.83	.004*
Within Subjects	51.37	108	.48		
Trial	117.96	2	58.98	124.01	.000*
Gender X Trial	2.94	2	1.47	3.10	.049*
Experience X Trial	6.05	2	3.03	6.36	.002*
Gend X Exper X Trial	4.63	2	2.31	4.87	.009*

* significant at $p<.05$

Appendix B-2

ONE-WAY ANOVA SUMMARY TABLES COMPARING NOVICE WOMEN AND NOVICE MEN FOR PERCEIVED PAIN AT EACH TRIAL

	Perceived Pain Inventory				
Source	SS	df	MS	F	p
Pre-Workout Trial					
Main Effects					
Gender	.009	1	.009	.095	.760
Residual	2.701	29	.093		
Total	2.710	30	.090		
Mid-Workout Trial					
Main Effects					
Gender	13.248	1	13.248	11.730	.002*
Residual	32.752	29	1.129		
Total	46.000	30	1.533		
Post-workout trial					
Main Effects					
Gender	8.964	1	8.964	7.778	.009*
Residual	33.423	29	1.153		
Total	42.387	30	1.413		

* significant at $p<.05$

Appendix B-3

ONE-WAY ANOVA SUMMARY TABLES COMPARING VARSITY WOMEN AND VARSITY MEN FOR PERCEIVED PAIN AT EACH TRIAL

	Perceived Pain Inventory				
Source	SS	df	MS	F	p
Pre-Workout Trial					
Main Effects					
Gender	.008	1	.008	.071	.792
Residual	2.659	25	.106		
Total	2.667	26	.103		
Mid-Workout Trial					
Main Effects					
Gender	.111	1	.111	.213	.649
Residual	13.074	25	.523		
Total	13.185	26	.507		
Post-workout trial					
Main Effects					
Gender	.465	1	.465	.502	.485
Residual	23.165	25	.927		
Total	23.630	26	.909		

* significant at $p<.05$

Appendix B-4

ONE-WAY ANOVA SUMMARY TABLES COMPARING NOVICE WOMEN AND VARSITY WOMEN FOR PERCEIVED PAIN AT EACH TRIAL

	Perceived Pain Inventory				
Source	SS	df	MS	F	p
Pre-Workout Trial					
Main Effects					
Experience	.001	1	.001	.014	.907
Residual	1.832	22	.083		
Total	1.833	23	.080		
Mid-Workout Trial					
Main Effects					
Experience	15.014	1	15.014	20.717	.000*
Residual	15.944	22	.725		
Total	30.958	23	1.346		
Post-workout trial					
Main Effects					
Experience	11.308	1	11.308	12.660	.002*
Residual	19.308	22		.893	
Total	30.958	23		1.346	

* significant at $p<.05$

Appendix B-5

ONE-WAY ANOVA SUMMARY TABLES COMPARING NOVICE MEN AND VARSITY MEN FOR PERCEIVED PAIN AT EACH TRIAL

	Perceived Pain Inventory				
Source	SS	df	MS	F	p
Pre-Workout Trial					
Main Effects					
Experience	.002	1	.002	.015	.904
Residual	3.528	32	.110		
Total	3.529	33	.107		
Mid-Workout Trial					
Main Effects					
Experience	.147	1	.147	.158	.694
Residual	29.882	32	.934		
Total	30.029	33	.910		
Post-workout trial					
Main Effects					
Experience	.004	1	.004	.003	.955
Residual	36.938	32	1.154		
Total	36.941	33	1.119		

* significant at $p<.05$

Appendix B-6

TUKEY SUMMARY TABLE OF SIGNIFICANT TRIAL MAIN EFFECTS FOR PERCEIVED PAIN INTENSITY

Comparison	*q*
Pre-workout to Mid-workout	16.38*
Pre-workout to Post-workout	20.23*
Mid-workout to Post-workout	3.85*

* significant at $p<.05$

Appendix C

STATISTICAL TABLES FOR THE FIVE CONSTRUCTS: COPING, COGNITIVE, CATASTROPHIZING, AVOIDANCE, BODY AWARENESS, AND THE COMPOSITE HURT INDEX OF THE SPORTS INVENTORY FOR PAIN

Appendix C-1

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR THE COPING CONSTRUCT

		Coping Construct			
Source	SS	df	MS	F	p
Between Subjects	2203.73	54	40.81		
Gender	30.66	1	30.66	.75	.390
Experience	11.76	1	11.76	.29	.594
Gender X Experience	81.56	1	81.56	2.00	.163
Within Subjects	612.84	108	5.67		
Trial	34.75	2	17.38	3.06	.051*
Gender X Trial	2.00	2	1.00	.18	.839
Expereince X Trial	1.70	2	.85	.15	.861
Gend X Exper X Trial	32.35	2	16.18	2.85	.062

* significant at p<.05

Appendix C-2

TUKEY SUMMARY TABLE OF SIGNIFICANT TRIAL MAIN EFFECTS FOR THE COPING CONSTRUCT

Comparison	q
Pre-workout to Mid-workout	.62
Pre-workout to Post-workout	3.50*
Mid-workout to Post-workout	2.88

* significant at p<.05

Appendix C-3

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE FOR THE COGNITIVE CONSTRUCT

Cognitive Construct					
Source	SS	df	MS	F	p
Between Subjects	1523.91	54	28.22		
Gender	21.74	1	21.74	.77	.384
Experience	68.86	1	68.86	2.44	.124
Gender X Experience	2.58	1	2.58	.09	.764
Within Subjects	230.03	108	2.13		
Trial	1.70	2	.85	.40	.671
Gender X Trial	.87	2	.43	.20	.816
Experience X Trial	14.38	2	7.19	3.37	.038*
Gend X Exper X Trial	3.44	2	1.72	.81	.448

* significant at $p<.05$

Appendix C-4

SIMPLE EFFECTS SUMMARY TABLE OF SIGNIFICANT

EXPERIENCE X TRIAL FOR THE COGNITIVE CONSTRUCT

Comparison	F
Pre: varsity to novice	5.12*
Mid: varsity to novice	1.93
Post: varsity to novice	.44

* significant at $p<.05$

Appendix C-5

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR THE CATASTROPHIZING CONSTRUCT

	Catastrophizing Construct				
Source	SS	df	MS	F	p
Between Subjects	1042.34	54	19.30		
Gender	65.55	1	65.55	3.40	.071
Experience	.67	1	.67	.03	.853
Gender X Experience	2.92	1	2.92	.15	.699
Within Subjects	200.39	108	1.86		
Trial	.27	2	.14	.07	.930
Gender X Trial	.12	2	.06	.03	.967
Expereince X Trial	.02	2	.01	.01	.995
Gend X Exper X Trial	3.16	2	1.58	.85	.429

* significant at p<.05

Appendix C-6

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR THE AVOIDANCE CONSTRUCT

Source	SS	df	MS	F	p
	Avoidance Construct				
Between Subjects	934.92	54	17.31		
Gender	4.73	1	4.73	.27	.603
Experience	10.92	1	10.92	.63	.431
Gender X Experience	126.56	1	126.56	7.31	.009
Within Subjects	252.89	108	2.34		
Trial	1.05	2	.52	.22	.800
Gender X Trial	.64	2	.32	.14	.873
Expereince X Trial	12.88	2	6.44	2.75	.068
Gend X Exper X Trial	.02	2	.01	.00	.996

* significant at p<.05

Appendix C-7

DUNN-BONFERRONNI SUMMARY TABLE OF SIGNIFICANT

GENDER X EXPERIENCE FOR THE AVOIDANCE CONSTRUCT

Comparison	t
Novice women to varsity women	.71
Novice women to novice men	.76
Novice men to varsity men	1.44
Varsity women to varsity men	1.29

* significant at p<.05

Appendix C-8

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR THE BODY AWARENESS CONSTRUCT

	Body Awareness				
Source	SS	df	MS	F	p
Between Subjects	944.36	54	17.49		
Gender	128.88	1	128.88	7.37	.009*
Experience	76.02	1	76.02	4.35	.042*
Gender X Experience	1.14	1	1.14	.06	.800
Within Subjects	452.71	108	4.19		
Trial	8.47	2	4.24	1.01	.367
Gender X Trial	14.89	2	7.44	1.78	.174
Experience X Trial	4.98	2	2.49	.59	.554
Gend X Exper X Trial	5.65	2	2.82	.67	.512

* significant at $p<.05$

Appendix C-9

SIMPLE EFFECTS SUMMARY TABLE OF SIGNIFICANT GENDER X TRIAL FOR THE BODY AWARENESS CONSTRUCT

Comparison	F
Pre: women to men	2.81
Mid: women to men	9.17*
Post: women to men	1.71

* significant at $p<.05$

Appendix C-10

SIMPLE EFFECTS SUMMARY TABLE OF SIGNIFICANT

EXPERIENCE X TRIAL FOR THE BODY AWARENESS CONSTRUCT

Comparison	F
Pre: varsity to novice	3.66
Mid: varsity to novice	5.34*
Post: varsity to novice	1.38

* significant at $p<.05$

Appendix C-11

GENDER X EXPERIENCE X TRIAL ANOVA SUMMARY TABLE

FOR THE COMPOSITE HURT INDEX

	Composite Hurt Index				
Source	SS	df	MS	F	p
Between Subjects	8852.32	54	163.93		
Gender	419.07	1	419.07	2.56	.116
Experience	85.37	1	85.37	.52	.474
Gender X Experience	5.39	1	5.39	.03	.857
Within Subjects	1727.35	108	15.99		
Trial	56.69	2	28.35	1.77	.175
Gender X Trial	3.05	2	1.52	.10	.909
Expereince X Trial	.75	2	.38	.02	.977
Gend X Exper X Trial	61.78	2	30.89	1.93	.150

* significant at $p<.05$

Appendix D

MEANS AND STANDARD DEVIATIONS FOR THE PERCEIVED PAIN INVENTORY AND THE SPORTS INVENTORY FOR PAIN

Appendix D-1

PERCEIVED PAIN INVENTORY SCORES FOR EACH OF THE SUBJECT SUB-GROUPS AT EACH TRIAL

	Pre-workout		Mid-workout		Post-workout	
Subjects	M	SD	M	SD	M	SD
Novice women	.08	.28	2.77	.93	2.92	.86
Varsity women	.09	.30	1.18	.75	1.55	1.03
Novice men	.11	.32	1.44	1.15	1.83	1.20
Varsity men	.13	.34	1.31	.70	1.81	.91
All	.10	.30	1.66	1.09	2.02	1.12

Appendix D-2

SPORTS INVENTORY FOR PAIN SCORES BY CONSTRUCT FOR EACH OF THE SUBJECT SUB-GROUPS AT EACH TRIAL

Coping Construct (COP)

	Pre-workout		Mid-workout		Post-workout	
Subjects	M	SD	M	SD	M	SD
Novice women	29.50	4.38	28.33	4.60	29.83	4.09
Varsity women	29.18	4.42	30.64	4.03	30.46	5.48
Novice men	30.56	5.14	31.72	4.65	32.17	4.15
Varsity men	29.35	2.83	28.88	3.12	30.41	2.94
All	29.72	4.19	29.98	4.25	30.85	4.11

Cognitive Construct (COG)

	Pre-workout		Mid-workout		Post-workout	
Subjects	M	SD	M	SD	M	SD
Novice women	17.50	2.36	16.75	3.17	16.50	3.32
Varsity women	15.36	3.38	15.90	3.11	16.36	3.26
Novice men	17.94	3.19	17.89	3.63	17.83	3.85
Varsity men	16.12	2.30	16.06	3.19	16.88	3.43
All	16.83	3.11	16.74	3.33	17.00	3.47

Catastrophising Construct (CAT)

Subjects	Pre-workout M	Pre-workout SD	Mid-workout M	Mid-workout SD	Post-workout M	Post-workout SD
Novice women	11.50	3.11	11.50	3.66	11.92	2.88
Varsity women	12.18	2.64	12.00	1.73	11.91	2.07
Novice men	10.78	2.67	10.67	3.20	10.50	2.33
Varsity men	10.35	3.14	10.47	2.67	10.71	2.44
All	11.07	2.91	11.03	2.92	11.12	2.46

Avoidance Construct (AVD)

Subjects	Pre-workout M	Pre-workout SD	Mid-workout M	Mid-workout SD	Post-workout M	Post-workout SD
Novice women	12.08	2.71	11.50	3.21	11.08	3.19
Varsity women	12.55	3.17	12.91	3.15	12.91	3.27
Novice men	13.39	2.43	12.83	1.79	12.67	2.00
Varsity men	10.41	2.50	10.71	2.80	11.00	2.87
All	12.09	2.85	11.95	2.79	11.90	2.83

Body Awareness Construct (BOD)

Subjects	Pre-workout M	Pre-workout SD	Mid-workout M	Mid-workout SD	Post-workout M	Post-workout SD
Novice women	13.00	2.13	12.17	2.59	12.67	2.43
Varsity women	11.36	3.98	10.46	3.21	12.46	4.78
Novice men	14.44	3.38	14.72	3.29	14.44	2.83
Varsity men	13.18	1.78	13.00	2.37	12.88	2.00
All	13.19	3.02	12.88	3.20	13.24	3.06

Composite Construct (HURT)

Subjects	Pre-workout M	Pre-workout SD	Mid-workout M	Mid-workout SD	Post-workout M	Post-workout SD
Novice women	23.42	7.44	22.08	9.63	23.33	8.23
Varsity women	19.82	7.43	21.64	6.77	22.00	6.50
Novice men	24.33	7.52	26.11	8.81	26.83	9.02
Varsity men	24.71	8.28	23.77	7.86	25.59	7.99
All	23.40	7.73	23.74	8.35	24.83	8.13

Appendix E

RAW DATA

Appendix E-1

RAW DATA: SUBJECT CHARACTERISTICS

Subject	Age	Gender	Rowing Years	Level	Athletic Years	Injury Number	Injury Extent	Injured
1	19	female	2	varsity	6		1	no
2	18	male	1	novice	13		1	no
3	19	male	1	novice	4	8	4	no
4	21	male	1	novice	6	10	5	no
5	18	male	1	novice	12		1	no
6	19	female	2	varsity	15	10	7	no
7	19	male	1	novice	6		1	no
8	18	male	1	novice	4	10	3	no
9	18	male	1	novice	5	1	7	no
10	18	male	3	novice	5		1	no
11	19	male	1	novice	5		1	no
12	18	male	1	novice	4		1	no
13	19	male	1	novice	4	1	2	no
14	18	male	1	novice	5	6	3	no
15	18	male	1	novice	1		1	no
16	19	female	1	novice	7	5	4	no
17	19	male	1	novice	5		1	no
18	18	male	1	novice	5		1	no
19	18	male	1	novice	6		1	no
20	19	male	1	novice	7		2	no
21	18	male	5	novice	5	1	3	no

Subject	Age	Gender	Rowing Years	Level	Athletic Years	Injury Number	Injury Extent	Injured
23	18	male	1	novice	1	1	1	no
24	18	female	1	novice	4		1	no
25	18	female	1	novice	5	2	4	no
26	19	female	1	novice				yes
27	20	female	1	novice	2		1	no
28	19	female	1	novice	5	4	2	no
29	19	female	1	novice	4		1	no
30	18	female	1	novice	6	1	6	no
31	18	female	1	novice	5	1	4	no
32	18	female	1	novice	7	3	5	no
33	18	female	1	novice	8	1	7	no
34	19	female	1	novice	5	3	2	no
35	18	female	1	novice	9	4	4	yes
36	20	female	3	varsity	3		1	no
37	20	female	2	varsity	6	6	2	no
38	20	female	3	varsity	7	3	5	no
39	21	female	3	varsity	7	2	3	no
40	21	female	3	varsity	4	1	4	no
41	21	female	3	varsity	7	7	7	no
42	21	female	2	varsity	7	1	2	no
43	19	female	2	varsity	2		1	no
44	21	female	3	varsity	7	1	1	yes
45	19	female	2	varsity	2	1	6	yes

Subject	Age	Gender	Rowing Years	Level	Athletic Years	Injury Number	Injury Extent	Injured
46	20	female	5	varsity	5	1	3	no
47	20	female	3	varsity	8	5	5	no
48	19	female	2	varsity	7		2	no
49	20	female	3	varsity	14	2	2	no
50	20	female	2	varsity	6	1	1	no
51	20	female	4	varsity	8	5	7	no
52	20	female	3	varsity	9	2	5	no
55	22	female	2	varsity	6	1	1	no
56	19	female	2	varsity	6	4	5	yes
57	19	male	4	varsity	14		1	no
58	20	male	1	novice	3	9	4	no
59	22	male	3	varsity	6		1	no
60	20	male	2	varsity				
61	20	male	3	varsity	7	3	6	no
63	20	male	3	varsity	7	1	7	no
64	20	male	3	varsity	6	2	7	no
65	21	male	1	varsity	6	2	7	no
66	21	male	3	varsity	7		1	no
67	21	male	3	varsity	7	2	2	no
68	19	male	2	varsity	6		2	no
69	22	male	2	varsity	5	1	2	yes
70	19	male	1	varsity	3	5	6	yes
71	22	male	4	varsity				no

Subject	Age	Gender	Rowing Years	Level	Athletic Years	Injury Number	Injury Extent	Injured
72	20	male	2	varsity	6	3	6	yes
73	20	male	4	varsity	6		2	no
74	20	male	5	varsity	7	1	2	no
75	20	male	3	varsity	6		1	no
78	20	male	3	varsity	3	2	2	no
79	21	male	4	varsity	8		1	no
80	19	male	2	varsity	4	1	6	no
81	22	male	3	varsity	6	5	7	no
82	20	male	8	varsity	8	1	3	no
83	22	male	3	varsity	9	2	7	no
84	20	male	2	varsity	10	3	4	no

Appendix E-2

RAW DATA: PERCEIVED PAIN INVENTORY (PPI) AND

SPORTS INVENTORY OF PAIN (SIP) CONSTRUCT SCORES

			SIP Constructs				
Subject	Trial	PPI	Coping	Cognitive	Catastrophizing	Avoidance	Body
1	Pre	0	23	16	12	9	12
	Mid	2	27	18	12	11	12
	Post	3	32	19	7	8	10
2	Pre	0	39	17	12	16	19
	Mid	2	37	23	6	11	17
	Post	3	35	21	9	8	18
3	Pre	0	31	18	9	14	11
	Mid	1	31	16	7	15	10
	Post	1	31	18	8	15	10
4	Pre	0	21	14	12	12	11
	Mid	1	23	13	13	12	15
	Post	0	25	11	13	13	15
5	Pre	0	35	17	8	14	18
	Mid	0	35	17	7	13	20
	Post	1	35	17	7	14	19
6	Pre	0	23	13	11	14	9
	Mid	2	23	10	9	10	9
	Post	3	24	13	12	10	9
7	Pre	0	27	16	11	9	16
	Mid	2	29	14	14	13	14
	Post	2	24	11	11	12	15

			SIP Constructs				
Subject	Trial	PPI	Coping	Cognitive	Catastrophizing	Avoidance	Body
8	Pre	0	27	19	14	15	15
	Mid	3	31	20	12	11	13
	Post	3	33	21	14	11	13
9	Pre		36	16	11	13	15
	Mid		37	16	10	13	16
	Post		32	18	10	12	14
10	Pre		27	14	8	13	14
	Mid		28	17	9	11	14
	Post		30	18	10	13	13
11	Pre	0	35	25	17	18	20
	Mid	0	40	25	18	14	20
	Post	0	37	24	14	17	19
12	Pre	0	23	19	12	16	16
	Mid	2	26	18	12	12	14
	Post	2	30	18	11	13	14
13	Pre	0	33	23	10	10	12
	Mid	0	28	19	11	12	11
	Post	3	38	19	8	10	13
14	Pre	0	28	15	8	12	18
	Mid	1	31	14	8	12	18
	Post	1	31	16	9	13	15
15	Pre	0	37	14	11	12	15
	Mid	3					
	Post	3	32	16	7	13	13

Subject	Trial	PPI	SIP Constructs: Coping	Cognitive	Catastrophizing	Avoidance	Body
16	Pre	0	32	17	13	9	12
	Mid	4	26	14	13	11	13
	Post	3	33	14	11	7	14
17	Pre	0	32	18	15	14	16
	Mid	2	32	15	15	12	19
	Post	2	32	17	12	12	17
18	Pre	0	39	22	6	13	17
	Mid	2	38	22	8	13	16
	Post	2	39	24	9	13	14
19	Pre	0	25	14	10	12	9
	Mid	3	28	13	12	15	11
	Post	4	27	12	14	12	8
20	Pre	1	29	14	10	11	15
	Mid	3	28	16	12	11	13
	Post	3	30	15	13	14	14
21	Pre	0	31	17	14	8	13
	Mid	2	25	16	15	9	12
	Post	3	28	18	12	7	13
23	Pre	0	32	14	9	8	16
	Mid	0					
	Post	1	36	14	8	7	16
24	Pre	0	31	15	10	11	16
	Mid	2	28	13	11	9	14
	Post	2					

Subject	Trial	PPI	SIP Constructs: Coping	Cognitive	Catastrophizing	Avoidance	Body
25	Pre	0	27	17	14	12	13
	Mid	3	27	15	14	12	11
	Post	3	27	16	15	11	9
26	Pre	0	29	17	15	15	15
	Mid	4	20	15	18	14	10
	Post	2	27	18	16	13	13
27	Pre	0	20	13	10	12	13
	Mid	3	24	15	8	8	10
	Post	4	22	11	11	10	10
28	Pre	0	31	19	14	16	14
	Mid	4	32	20	15	16	14
	Post	4	32	20	15	16	14
29	Pre	0	31	19	14	12	13
	Mid	2	28	20	12	12	14
	Post	3	27	20	15	12	14
30	Pre	1	32	21	10	13	13
	Mid	1	32	23	9	8	13
	Post	2	35	22	9	9	12
31	Pre	0	31	19	14	13	10
	Mid	3	26	18	15	13	8
	Post	3	29	16	14	12	10
32	Pre	0	22	14	4	16	12
	Mid	2	25	12	5	16	14
	Post	2	27	13	8	16	14

			SIP Constructs				
Subject	Trial	PPI	Coping	Cognitive	Catastrophizing	Avoidance	Body
33	Pre	0	34	20	10	8	18
	Mid	3	30	18	10	9	17
	Post	4	30	17	10	9	18
34	Pre	0	32	18	10	9	10
	Mid	2	36	14	9	6	9
	Post	2	33	13	9	6	12
35	Pre	0	33	16	10	10	13
	Mid	3	34	17	10	13	13
	Post	4	36	18	10	12	12
36	Pre	0	33	15	15	14	12
	Mid	1	35	15	12	13	12
	Post	0	37	16	13	12	10
37	Pre	0	28	16	10	10	13
	Mid	1	25	16	9	9	11
	Post	2	26	15	14	11	10
38	Pre	0	26	16	10	14	11
	Mid	1	30	17	12	14	11
	Post	1	30	20	12	14	11
39	Pre	0	33	15	10	14	7
	Mid	2	33	17	10	12	9
	Post	3	28	17	10	12	9
40	Pre	0	22	14	11	9	11
	Mid	1	25	15	11	9	12
	Post	3	23	16	13	9	11

Subject	Trial	PPI	SIP Constructs Coping	Cognitive	Catastrophizing	Avoidance	Body
41	Pre	0	24	15	14	15	18
	Mid	0	30	17	12	14	15
	Post	1	29	17	10	16	15
42	Pre	0	33	14	12	11	14
	Mid	1	32	14	13	11	15
	Post	1	35	16	10	14	14
43	Pre	0	28	16	14	14	9
	Mid	1	30	16	13	14	10
	Post	1	33	18	12	14	7
44	Pre	0	35	14	12	18	5
	Mid	1	35	10	14	20	6
	Post	2	38	10	14	20	6
45	Pre	1	22	14	13	15	10
	Mid	1	25	15	10	12	11
	Post	2	26	15	11	11	11
46	Pre	1	27	11	9	12	9
	Mid	1	28	16	10	15	7
	Post	1	23	19	10	13	10
47	Pre	0	29	16	11	10	10
	Mid	2	23	16	12	12	8
	Post	2	25	16	12	13	8
48	Pre	0	24	15	9	14	13
	Mid	2	29	19	12	14	10
	Post	1	27	20	11	14	9

Subject	Trial	PPI	SIP Constructs: Coping	Cognitive	Catastrophizing	Avoidance	Body
49	Pre	0	27	11	18	8	13
	Mid	2	32	12	15	9	11
	Post	2	32	11	16	8	11
50	Pre	0	28	14	9	16	16
	Mid	2	29	13	8	14	15
	Post	2	29	10	8	13	14
51	Pre	0	35	23	11	9	18
	Mid	0	35	22	10	10	16
	Post	0	37	20	9	11	16
52	Pre	0	30	19	13	15	11
	Mid	2	31	18	14	14	8
	Post	2	33	18	12	14	11
55	Pre	0	27	19	9	9	14
	Mid	2	27	16	11	11	10
	Post	3	33	19	11	13	12
56	Pre	1	38	21	13	10	6
	Mid	3	29	15	20	18	9
	Post	3	33	18	20	18	7
57	Pre	0	25	8	18	10	12
	Mid	1	30	7	15	12	12
	Post	1	35	8	14	16	12
58	Pre	0	31	19	9	14	11
	Mid	0	36	21	8	13	15
	Post	0	36	20	9	14	16

			SIP Constructs				
Subject	Trial	PPI	Coping	Cognitive	Catastrophizing	Avoidance	Body
59	Pre	0	26	14	15	18	11
	Mid	2	24	15	15	15	17
	Post	2	29	17	16	17	11
60	Pre	0	22	17	15	14	8
	Mid	2	24	19	16	14	8
	Post	3	24	20	16	12	8
61	Pre	0	34	14	7	9	13
	Mid	2	32	17	7	9	8
	Post	3	27	14	8	10	10
63	Pre		28	18	6	8	14
	Mid		34	20	12	17	14
	Post		36	21	7	10	13
64	Pre	0	30	13	8	13	15
	Mid	1	31	12	8	11	16
	Post	2	31	11	9	12	15
65	Pre		27	21	9	11	11
	Mid		33	22	11	11	14
	Post		32	21	10	11	14
66	Pre	0	30	17	8	10	16
	Mid	0	26	18	10	8	14
	Post	0	26	18	10	11	16
67	Pre	0	35	17	8	9	11
	Mid	2	32	19	8	8	14
	Post	2	32	19	9	8	16

			SIP Constructs				
Subject	Trial	PPI	Coping	Cognitive	Catastrophizing	Avoidance	Body
68	Pre	1	32	17	10	10	14
	Mid	1	32	17	12	10	14
	Post	0	33	19	9	7	13
69	Pre	1	29	10	9	11	13
	Mid	1	28	12	10	10	11
	Post	1	29	12	10	10	10
70	Pre	1	32	16	11	17	10
	Mid	1	28	18	8	18	9
	Post	2	32	18	8	14	12
71	Pre	0					
	Mid	0	26	14	10	10	12
	Post	3	27	14	13	11	13
72	Pre	2	25	13	10	16	12
	Mid	3	22	12	9	17	11
	Post	3	23	14	9	17	11
73	Pre	1	27	18	12	11	13
	Mid	2	30	18	10	8	14
	Post	3	30	17	10	10	13
74	Pre	0	32	19	10	9	12
	Mid	2	30	19	7	7	13
	Post	1	34	20	7	7	16
75	Pre	0	28	16	10	9	11
	Mid	1	27	16	11	10	10
	Post	1	31	16	14	11	10

Subject	Trial	PPI	SIP Constructs				
			Coping	Cognitive	Catastrophizing	Avoidance	Body
78	Pre	0	26	19	10	10	16
	Mid	1	25	17	11	10	12
	Post	1	29	18	11	9	12
79	Pre	0	32	17	9	8	15
	Mid	2	34	16	9	8	14
	Post	2	34	20	11	8	13
80	Pre	0	32	20	14	11	13
	Mid	2	28	19	12	7	11
	Post	4	31	20	12	10	11
81	Pre	0	29	19	12	10	11
	Mid	1	28	18	12	13	10
	Post	2	27	18	12	13	11
82	Pre	1	29	14	9	12	12
	Mid	1	29	12	8	13	11
	Post	1	29	14	11	13	11
83	Pre	0	30	20	12	10	15
	Mid	1	26	16	11	13	16
	Post	2	29	20	11	12	14
84	Pre	0	29	14	9	14	13
	Mid	3	29	13	10	13	16
	Post	3	30	14	8	13	12