PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF AN ACUTE STRESSOR:
COMPARING COPING STRATEGIES AMONG VERY PHYSICALLY
ACTIVE AND LESS ACTIVE ADULTS

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The purpose of this study was to examine whether physical activity status of healthy adult males ($N = 59$) while in a coping strategy condition (association, disassociation, or control) influences psychophysiological responses to an acute painful stimulus. Measures of pain tolerance, state anxiety, body awareness, and salivary cortisol were investigated. Results indicated no significant differences between physical activity groups for pain tolerance, stress responses (i.e., self-reported state anxiety and cortisol levels), or body awareness. Though, those who indicated using a disassociation coping technique during the exit interview tolerated the acute, surface pain longer. More research is required to further understand the effects of physical activity and coping strategies on pain perception and psychophysiological responses.
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PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF AN ACUTE STRESSOR: COMPARING COPING STRATEGIES AMONG VERY PHYSICALLY ACTIVE AND LESS ACTIVE ADULTS

Introduction

The human body is usually in some state of stress, whether pleasant (i.e., eustress) or unpleasant (i.e., distress), mild or severe (Nelson & Simmons, 2011; p. 55-74). In unpleasant or stressful situations, such as dealing with pain, individuals' mental and physical health may depend on their perception of stressors. Stressors perceived as very intense may result in changes to psychological (e.g., increased anxiety) and physiological (e.g., high levels of cortisol) responses (Dienstbier, 1991; Gaab, Rohleder, Nater, & Ehlert, 2005; Sothmann, Buckworth, Claytor, Cox, White-Welkley, & Dishman, 1996). This can lead to negative health outcomes associated with both mental (e.g., depression) and physical (e.g., cardiovascular disease) wellbeing (Bond et al., 2009; Chida & Steptoe, 2008). Individuals' interpretations and reactions to stressors may be influenced by their experiences with pain, such as physical activity (Lazarus, 1999). In fact, engaging in regular physical activity can alter the body’s responses to different types of stressors (Sothmann et al., 1996). The cross-stressor adaptation hypothesis indicates that physical activity is a stressor on the body, which may change how the body responds to other types of stressors (Sothmann et al., 1996). In addition, personal resources, such as cognitive and emotional coping strategies, may change individuals’ perception of stressors to be less stressful (Alderman, Arent, Landers & Rogers, 2007; Guszkowska, 2005; Lox et al., 2010), to stabilize or maintain normal various physiological responses (Gaab et al., 2005). Research indicates when acute pain is perceived as unmanageable, specific changes include exacerbated cognitive and emotional distress resulting in increased cognitive and somatic state anxiety, (Koltyn &
Arbogast, 1998; Koltyn et al., 1999) and causing an increase in cortisol levels (Bullinger et al., 1984). Examining individuals’ physical activity level (e.g., very physically active versus less physically active) and coping strategies (e.g., association or dissociation cognitive strategies), may provide an understanding of how their perception of stress elicits the stress response (e.g., increased state anxiety and cortisol levels). Unfortunately, limited information exist on whether individuals' physical activity level and use of coping strategies (a) alter pain perceptions to reduce the intensity of perceived stress and (b) allow physical stressors to be tolerated longer for situations where it is important to manage pain effectively.

Pain Perception

The pain sensation is a multifaceted process that involves psychological and physiological responses. Understanding how various types of pain are experienced is important to determine ways to minimize the elicited stress response (Hwang et al., 2008). Research has focused on how acute (Bullinger et al., 1984; Koltyn & Arbogast, 1998; Koltyn, Focht, Ancker, & Pasley, 1999) and chronic (Nichols & Glenn, 1994; Ullrich, Turner, Ciol, & Berger, 2005; Vedhara et al., 2002; Wittrock & Myers, 1998) pain elicits a psychophysiological stress response in both experimental and natural situations.

The psychophysiological response may depend on how the pain is perceived. Individuals who perceive acute pain (i.e., the stressor) to be threatening and uncontrollable (i.e., unmanageable) will not cope effectively (Nichols & Glenn, 1994), resulting in higher levels of cortisol (Bullinger et al., 1984) whereas those who perceive pain as familiar and controllable will have lower levels of cortisol (Dienstbier, 1991). As a result, lower cortisol levels are not expected in perceived threatening, uncontrollable stressful situations as it is in perceived familiar, controllable stressful situations (Lox et al., 2010). In addition, individuals who perceive
the stressful situation or experience as familiar and controllable will likely be able to cope or persist longer than those who view the situation or experience as threatening, unfamiliar, and uncontrollable (Verduyn, Van Mechelen, & Tuerlinckx, 2011). An example of a stressful situation perceived as familiar and controllable is engaging in regular moderate or vigorous physical activity (Klaperski, Dawans, Heinrichs, & Fuchs, 2012; Sothmann et al., 1996). Initially, moderate or vigorous physical activity may induce discomfort (i.e., short-lived pain and fatigue) and the experience may be viewed as highly stressful. Overtime, individuals adapt physically and mentally to the stressful experience (Fox, 1999). While many studies (e.g., Bullinger et al., 1984; Koltyn & Arbogast, 1998; Koltyn, Focht, Ancker, & Pasley, 1999; Nichols & Glenn, 1994; Traustadóttir et al., 2005; Ullrich, Turner, Ciol, & Berger, 2005; Vedhara et al., 2002; Wittrock & Myers, 1998) have investigated the psychophysiological responses to acute stressors (e.g., acute pain and psychosocial), few studies (e.g., Klaperski et al., 2012) have directly investigated how individuals differ in their response with respect to their physical activity level.

Physical Activity Level

Physical activity level is one factor that seems to result in differences in the experience of acute stress. Specifically, moderate and vigorous physical activity appears to be associated with alterations in the stress response by reducing cortisol responses (Klaperski et al., 2012; Traustadóttir et al., 2005). Yet, the type of stressor and the definition of physical activity differ across studies.

Klaperski et al. (2012) examined the Cross-stressor adaptation hypothesis with regularly active women classified as either inactive (engaging in less than 2 hours of aerobic exercise per week), moderately active (engaging in 2 to 6 hours of aerobic exercise per week, or vigorously
active (engaging in more than 6 hours of aerobic exercise per week). Results of Klaperski and
colleagues’ study revealed that when moderately and vigorously exercising women were given
the psychosocial stressor, Trier Social Stress Test for Groups, their psychological stress
responses (i.e., state anxiety, calmness, or mood) were similar across groups, but physiological
stress responses (i.e., cortisol) were lower compared to the non-active women. Another study
employed the Matt Stress Reactivity Protocol, which involves mental challenges, a physical
challenge, and a psychosocial stressor with women who were considered aerobically fit with
V02max measures (Traustadóttir et al., 2005). The results of this study indicated that older women
had decreased sensitivity to painful stressors because compared to both young unfit and older
unfit women, their cortisol responses were lower (Traustadóttir et al., 2005). Caution should be
taken when considering this conclusion because young fit females did not have lower cortisol
levels. Although Traustadóttir et al. (2005) and Klaperski et al. (2012) suggest that being
aerobically active reduces the stress response, physical activity classification did not include any
resistance activity measures.

Past research indicates that both men and women report reduced pain sensations after low
intensity isometric exercise performed in short durations of 1, 3, and 5 minutes (Umeda,
Newcomb, Ellingson, & Koltyn, 2010). Pain thresholds were elevated while pain ratings were
reduced after each duration (i.e., 1, 3, and 5 minutes) of isometric exercise. The conclusion of
reduced pain sensations, also known as hypoalgesia, occurring as a result of isometric exercise is
in agreement with the findings of Koltyn and Arbogast (1998) who found pain thresholds
significantly raised 5 minutes after exercise. Koltyn and Arbogast (1998) concluded that
experimentally induced pain, after a single bout of resistance exercise, had significantly lower
pain ratings. Although the reported psychological measurements indicated that anxiety did not
change for either group, the Body Awareness Scale (BAS; Wang & Morgan, 1987) scores were significantly elevated after resistance exercise. The BAS evaluates the somatic component of anxiety (Stegner, Tobar, & Kane, 1999) so the elevated responses could have indicated that the participants were more aware of the sensations from exercise, such as their sweating and elevated heart rate, that focusing on these sensations diverted their attention away from the pain. It appears physically active individuals were familiar with the challenges (i.e., pain and body sensations) when engaging in physical activity and perceived the acute painful stressor as familiar and controllable. Individuals who were not active may have perceived the acute painful stressors as threatening and uncontrollable because they did not have experience with pain (e.g., physical activity) prior to the acute pain procedure (Dienstbier, 1991). As a result, it could not be determined whether the results indicated that physical activity acted as an analgesic effect or rather focusing on the physical activity sensations were a way to distract from the pain. Therefore, future research is needed to determine whether higher pain tolerance and physical activity (Koltyn & Arbogast, 1998) are attributed to either an analgesic effect or rather distraction from pain was used as a type of coping mechanism to manage stressors.

Coping Strategies

A second factor that seems to result in differences in the experience of acute pain is the way in which individuals cope with the pain. There are several types of coping mechanisms used to manage stressors (Keogh, Hatton, & Ellery, 2000) and individuals' prior experiences with psychological and physical demands influence the coping strategy used (Anshel, Sutarso, & Jubenville, 2009). Coping strategies reflect situational responses to acute stressors (Anshel et al., 2009) providing adaptation in crises (Folkman & Lazarus, 1984). The perception of acute stressors and the resulting emotional costs may depend on how well the chosen coping strategy
matches the situational demands. Thus, perceiving stressors as less challenging and controllable is ideal to reduce the psychological stress and physiological effects.

Previous studies (Bullinger et al., 1984; Keogh et al., 2000) have indicated that, for men, focusing on pain may be a useful approach to cope. Men using an association coping strategy (i.e., focusing on how the pain feels) reported lower sensory pain compared to those using an avoidance coping strategy known as disassociation where individuals try to avoid all thoughts about the pain (Keogh et al., 2000). Similarly, Bullinger et al. (1984) investigated whether self-controlling attitudes and behavior could influence a neuroendocrine response to noxious stimulation (e.g., beta-endorphin, cortisol, prolactin, growth hormone and opioid). Focusing on pain with an assertive coping style (i.e., association strategy) significantly reduced cortisol levels compared to a disassociation coping technique known as repression (Bullinger et al., 1984). However, these findings are not consistent across studies because in a non-patient population, the severity of pain increased when focusing on the pain (Hwang et al., 2008). Bullinger et al. (1984) provide an important, but cautious, interpretation that relations exist between coping styles employed and hormone levels; which suggests that coping techniques may reduce pain and lead to adaptive neuroendocrine responses. The findings of these studies (Bullinger et al., 1984; Hwang et al., 2008; Keogh et al., 2000) are inconclusive and, therefore, additional research is needed to examine these variables. Investigating the influence of using association and disassociation coping strategies to cope with acute pain is an aim of this study.

Limited research is available that examines the relationship between individuals’ coping strategies and psychophysiological responses to acute pain (e.g., Bullinger et al., 1984; Hwang et al., 2008; Keogh et al., 2000). Hence, more research is needed to examine the effect regular physical activity has on individuals’ perception of pain to influence their anxiety and cortisol
responses. Indeed, the discussed previous findings (Klaperski et al., 2012; Koltyn & Arbogast, 1998; Traustadottir et al., 2005) provides some evidence that physical activity, whether aerobic or resistance activity, may reduce the perception of pain.

Purpose of the Study

The current study, therefore, examined whether physical activity level and coping strategies influenced pain tolerance, reactivity, (i.e., psychological and physiological responses) and recovery (i.e., cortisol responses returning to normal levels) to an acute, physical stressor (i.e., surface pain). Stress reactivity was specifically examined with differences in state anxiety, body awareness, and cortisol levels of men who were classified as either very physically active or less physically active when using either an association or disassociation coping strategy or assigned to a control group. It was hypothesized that very physically active men would have higher pain tolerance and lower anxiety and cortisol reactivity in the association attentional focused condition. As evidence from the Cross-stressor adaptation hypothesis, very physically active men would perceive the acute pain as less challenging and controllable, thus having lower anxiety and cortisol levels (e.g., Sothmann et al., 1996). Also, as indicated from previously discussed studies (Bullinger et al., 1984; Keogh et al., 2000), the association focusing attentional technique should be better for coping with acute pain than a dissociation strategy. Furthermore, it was hypothesized that very physically active individuals would have faster recovery with cortisol measurements returning to normal levels as evidence from Traustadottir et al. (2005).

Methods

Participants

Sixty-four healthy college men volunteered to participate for this study but five men were eliminated due to not meeting the physical activity requirements (see physical activity status).
Results are therefore reported for the remaining 59 men. The estimated sample size was computed using an alpha of 0.05, a power of 0.80 and a moderate effect size of 0.30. Purposeful sampling (i.e., flyers and announcements made in classes) was used to recruit very physically active and less active men on campus from various courses and majors (e.g., kinesiology, psychology, etc.). Participants were initially screened to exclude factors or characteristics that have been shown to affect the physiological measures in the current study. The following exclusion criteria (Dickerson & Kemeny, 2004) were selected to enhance internal validity: men who currently suffered from chronic pain, had a history of cardiovascular disease or diabetes, or were currently on any medications. In the overall study sample, 21 men were considered less physically active and 38 men were considered very physically active. Characteristics of the sample are presented in Table 1.

Measures

*Physical activity status.* Physical activity status was determined using a self-report questionnaire (see Appendix D) that included recommendations provided by American College of Sports Medicine (ACSM; Garber, Blissmer, Deschenes, Franklin, Lamonte, Lee, Nieman, & Swain, 2011). To be considered eligible as very physically active for this study, men had to report that they engaged in the specified amount of vigorous-intensity aerobic activity and resistance activity recommended by ACSM for at least six months. The requirements included:

1. At least 20 minutes of vigorous-intensity activity three days each week (60 min/wk total)
2. Resistance training of each major muscle group two to three days per week

Conversely, men who reported being relatively healthy on the medical background questions in the demographics but reported engaging in vigorous or resistance activity for less than six months were considered less physically active and placed in the less physically active group. In
addition, if men reported engaging in vigorous activity equal to or less than 50 minutes/week were also considered less physically active and placed in the less physically active group. If men met the criterion for vigorous activity but did not engage in resistance training or vice versa, then they were eliminated from the study ($n = 7$). This physical activity status criterion was used to separate individuals into groups based on their aerobic and resistance activity responses (Garber et al., 2011). Second, comparing men who already maintain a very physically active lifestyle with those who do not maintain a very physically active lifestyle will maximize the results to be similar to a real world setting as compared to introducing a workout regimen that may not be continued after this study, thus limiting the implications.

Anxiety. Spielberg’s State Trait Anxiety Inventory form X (STAI; Spielberg, 1983) has been widely used to assess state anxiety in studies investigating the psychological effects of coping and pain as well as exercise and pain perceptions (e.g., Keogh et al., 2000; Koltyn et al., 1999). This instrument is reliable and valid for measuring acute stress, with alpha reliability coefficients for state scores ranging from 0.83 to 0.92 (Spielberg, 1983).

Body awareness. The Body Awareness Scale (BAS) has shown to contain convergent and discriminant validity (Stegner et al., 1999; Wang & Morgan, 1987) and is designed to assess somatic aspects of anxiety at that moment. The BAS has been used to investigate the psychological effects of exercise and pain perceptions (Koltyn et al., 1999; Koltyn, Raglin, O’Conner, & Morgan, 1995; Koltyn, Shake, & Morgan, 1993).

Salivary cortisol. Previous findings have shown salivary cortisol to be a valid and reliable endocrine marker of the HPA axis (Chida & Steptoe, 2009). Consequently, a rise in cortisol would indicate a stressful encounter (Feurstein et al., 1981) in this acute noxious stress setting. Cortisol was measured using Salivate (Salimetrics, State College, PA) and collected by
participants’ rolling a cotton swab in their mouth for two minutes. Saliva was stored in a container of ice until completion of the session. Samples were then stored at -80°C until biochemical analysis. Salivates were then centrifuged at 3000 rpm for 5 minutes, which resulted in a clear supernatant of low viscosity. Salivary free cortisol concentrations were measured using a commercially available chemi-luminescence-assay (CLIA) with high sensitivity of 0.16 ng/ml (Salimetrics, State College, PA).

Apparatus

The Forgione-Barber pain stimulator consisted of a Lucite edge contacting the finger with a 176.60g mass and applying a constant pressure on the finger with the weight of 99.3844lbs/s (Feurstein et al., 1981). This stimulus was selected as the experimental pain induction technique because it is an acute physical noxious stressor that produces a constant force on the finger without causing harm (Forgione & Barber, 1971) while providing an immediate bodily reaction (Feurstein, Bush, & Corbisiero, 1981). It has been previously found to possess excellent reliability and validity (Forgione & Barber, 1971; Koltyn et al., 1999).

Procedure

This study required two different sessions. The first meeting included: (a) obtaining written informed consent and (b) providing self-reported physical activity. Each participant read and signed an informed consent document that had been previously approved by the university’s Institutional Review Board. Participants were instructed verbally and in writing that they could not brush their teeth or eat food two hours prior to arriving at the lab. Additionally, on the day of reporting to the lab, the participants could not perform physical activity, intake any form of caffeine or alcohol in order to not compromise salivary cortisol sampling (Dickerson & Kemeny, 2004). After completion of the informed consent, participants were asked if they had any
questions and were free to leave. After participants had left, one of three attentional strategy conditions: (a) association, (b) disassociation, or (c) control were randomly assigned for their second session.

The second session included inflicting the acute noxious pain and collecting psychological and physiological measures (see measures). Participants began by sitting in a quiet room and completing demographic background questions and baseline STAI anxiety measures (see anxiety measures) during a ten-minute period. After completion of the background questions and STAI, participants stayed seated and relaxed until the end of ten minutes. At the end of the ten minutes, baseline cortisol measures were collected (see salivary cortisol measures) and participants were given their appropriate attention instructions for coping with the pain stimulator. Instructions for coping with the pain stimulator were given orally through recordings to help control for variability between participants. Participants in the association attention condition were instructed to concentrate on the sensations experienced from the pain stimulator. The investigator ensured the participants were focusing on the pain by telling them at 60s, 120s, 180s, 240s, and 300s to think about the pain. Those in the attentional disassociation condition were instructed to watch an educational movie clip provided. The investigator asked at every 60s questions about the show provided for the participant to answer aloud (e.g., “What color shirt is the actor wearing?”). Men in the control condition were instructed to tolerate the pain as long as possible while sitting in the same room but without any further instructions or distractions.

Following attention instructions, participants were instructed to insert their non-dominant hands’ forefinger into the chute of the pain stimulator (see apparatus) until they could no longer tolerate the pain. Unbeknown to the participant, an upper time limit of 360s was used, at which time the investigator released the participant from the pain stimulator. Pain tolerance was
measured as the point in time at which individuals could no longer tolerate the pain and withdrew from the stimulus, or the upper time limit 360s in which the investigator stopped the pain stimulator.

Following the pain stimulator, participants were instructed to complete a post STAI questionnaire and the BAS (see body awareness measures). A final exit question asked the participants what they were thinking about while in the pain stimulator to determine if the given coping strategy instructions were being employed. At fifteen and thirty minutes post stimulus, the second and third salivary cortisol measures were collected. The participants were told to relax for a final fifteen minutes (i.e., recovery) after which the final saliva sample was collected (45 minutes post pain stimulator). The participants were asked if they had any questions and were free to leave.

Salivary cortisol was measured at baseline and 15, 30 and 45 minutes post stimulus. Cortisol has a diurnal curve, thus all participants were assessed between 3:00 and 6:00pm of the day because this period has been described as a no-stress cortisol level time to collect salivary cortisol (Kalman & Grahn, 2004). The third saliva sample (post stimulus 30 minutes) was collected since previous research (Schoofs, Wolf, & Smeets, 2009) has shown salivary cortisol to spike 30 minutes after the end of an acute noxious stressor. The fourth and final saliva sample was collected to investigate which group’s cortisol levels would lower to normal range (i.e. recovery).

Data analysis. Data was managed and analyzed using SPSS® version 20. Initially, physical activity group differences were examined to compare their demographics as well as minutes performing physical activity. Pearson product moment correlations were then examined with physical activity groups to determine relations between the various dependent variables. A 2
(physical activity level: very active versus less active) by 3 (coping strategy: association, disassociation, or control) analysis of variance (ANOVA) was used to examine differences for pain tolerance. After reviewing the exit question that asked what the participants were thinking about when in the pain stimulator, regardless of their assigned coping strategy, association and disassociation coping strategies groups were created. A follow-up 2 (physical activity level: very active versus less active) by 2 (coping strategy: association, disassociation) ANOVA was conducted. For state anxiety, change scores were calculated (STAI post scores minus STAI pre scores) to assess anxiety reactivity. To assess psychological stress reactivity, a 2 (physical activity level: very active versus less active) by 3 (coping strategy: association, disassociation, or control) multivariate analysis of variance (MANOVA) was used with STAI change scores and BAS scores. Baseline differences for cortisol were analyzed with very physically active men and less active men using an ANOVA with repeated measures (before and after pain stimulator). To control for baseline values, further analyses were used with an analysis of covariance (ANCOVA) with repeated measures. To evaluate physiological stress reactivity, a 2 (physical activity level: very active versus less active) by 3 (coping strategy: association, disassociation, or control) ANCOVA with repeated measures was performed with cortisol. Based on the exit question and the creation of two coping strategy groups, a 2 (physical activity level: very active versus less active) by 2 (coping strategy: association versus disassociation) ANCOVA with repeated measures was then performed to assess differences in cortisol. Replicating previous research for stress recovery methods, (Klaperski et al., 2012) cortisol was assessed as the percentage of change in cortisol levels from samples collected after the pain stimulator at 15 minutes to 45 minutes (i.e., post 45 cortisol measures minus post 15 cortisol measures divided by post 15 cortisol measures multiplied by 100).
Results

Very physically active and less active participants did not differ significantly in terms of age, height, or weight. In accordance with the very physically active and less active group classification, the two groups differed significantly in self-reported minutes performed in a week of: vigorous physical exercise, \( F(3, 51) = 14.06, p < .001 \) and repetitions performed for resistance activity, \( F(3, 51) = 19.49, p < .001 \) along with length of time (in months) they have engaged in physical activity, \( F(3, 51) = 26.47, p < .001 \). On average, less active men performed 121 minutes of vigorous activity with 17 repetitions of resistance activity each week for a total of 2 months, whereas very active men performed 311 minutes of vigorous activity with 33 repetitions of resistance activity each week for a total of 51 months respectively (all \( p > .05 \), see Table 1 for exact \( p \) values).

Initially, Pearson product moment correlations were examined with the physical activity groups to assess relations between psychological measures (i.e., anxiety and body awareness) time tolerating pain, and the physiological measure, cortisol (see Table 2). Psychological measures also included a change score on the STAI for anxiety (i.e., post STAI minus pre STAI). For the very physically active group, Pearson product moment correlations indicated that STAI pre was statistically related to higher STAI post (\( r = .76, p < .01 \)) as well as higher BAS scores (\( r = .43, p < .01 \)). In addition, higher STAI post scores were statistically related to higher BAS scores (\( r = .53, p < .01 \)). However, neither STAI change scores nor time tolerating pain were associated with either psychological or physiological measures. Cortisol levels prior to the pain stimulus were related to measures taken after the pain stimulus at 15 minutes (\( r = .85, p < .01 \)), 30 minutes (\( r = .86, p < .01 \)), and 45 minutes (\( r = .84, p < .01 \)), but were not related to psychological measures or time tolerating pain. Cortisol levels at 15 minutes post pain stimulus were
statistically related to higher measures 30 minutes post pain stimulus \((r = .92, p < .01)\) and higher measures 45 minutes post pain stimulus \((r = .84, p < .01)\). Furthermore, cortisol taken at 30 minutes post pain stimulus was statistically related to higher cortisol measures taken 45 minutes post pain stimulus \((r = .86, p < .01)\).

For the less physically active group, Pearson product moment correlations indicated that STAI pre was statistically related to higher STAI post scores \((r = .50, p < .05)\). However, the BAS scores were not related to STAI pre scores \((r = .11, p > .05)\), STAI post scores \((r = .36, p > .05)\) or STAI change scores \((r = .24, p > .05)\). Time tolerating pain was not associated with any psychological or physiological measures. Cortisol levels prior to the pain stimulus were related to measures taken after the pain stimulus at 15 minutes \((r = .68, p < .01)\), 30 minutes \((r = .76, p < .01)\), and 45 minutes \((r = .69, p < .01)\), as well as post anxiety measures. However, cortisol was not related to body awareness or time tolerating pain. Cortisol levels at 15 minutes post pain stimulus were statistically related to higher measures 30 minutes post pain stimulus \((r = .93, p < .01)\) and higher measures 45 minutes post pain stimulus \((r = .67, p < .01)\). Furthermore, cortisol taken at 30 minutes post pain stimulus was statistically related to higher cortisol measures taken 45 minutes post pain stimulus \((r = .84, p < .01)\).

Pain Tolerance

Results of a 2 (physical activity groups) by 3 (assigned coping strategies: association, dissociation, and control) ANOVA revealed no significant main effects for physical activity, \(F(1, 53) = .01, p = 0.94\) nor assigned coping strategy, \(F(2, 53) = .20, p = 0.81\), for time tolerating the pain stimulus. In addition, there was no significant interaction between physical activity level and assigned coping strategy for length of time tolerating the pain stimulus, \(F(2, 53) = .97, p = 0.38\). However, based on the exit question regarding coping strategies actually used, a follow-up
2 (physical activity level) by 2 (coping strategy used: association and dissociation) ANOVA indicated a significant main effect for coping strategy to tolerate pain, $F(2, 53) = 6.72, p = .003$, $\eta_p^2 = .20$. Post hoc comparisons using the Tukey HSD test revealed that the disassociation coping strategy had higher pain tolerance ($M = 319.53, SD = 81.47$) compared to the association coping strategy ($M = 184.48, SD = 138.35$). However, there was no significant main effect for physical activity level, $F(1, 53) = 1.63, p = .21$, and no significant interaction existed between physical activity level and exit question coping strategy, $F(2, 53) = 1.23, p = .30$.

Anxiety and Body Awareness

Results of a 2 (physical activity groups) by 3 (assigned coping strategies: association, dissociation, and control) MANOVA on anxiety and body awareness revealed no significant main effects for physical activity level on anxiety, $F(1, 53) = 3.28, p = .08$ or body awareness, $F(1, 53) = .83, p = .37$. In addition, no main effects were found for assigned coping strategy on anxiety $F(2, 53) = 1.51, p = 0.23$ or body awareness $F(2, 53) = .43, p = .96$, and no significant interaction existed between physical activity and assigned coping strategy on anxiety $F(2, 53) = .54, p = .59$ or body awareness $F(2, 53) = 1.22, p = .30$. Means and standard deviations are provided in Table 3. Furthermore, results of a 2 (physical activity groups) by 2 (exit question coping strategy) ANOVA revealed no significant main effects for physical activity level on anxiety $F(1, 53) = 2.48, p = .12$, or body awareness $F(1, 53) = .89, p = .35$, or exit question coping strategy for anxiety, $F(2, 53) = .23, p = .80$, or body awareness $F(2, 53) = .55, p = .58$. No significant interaction existed between physical activity level and exit question coping strategy for anxiety $F(2, 53) = .10, p = .91$ or body awareness $F(1, 53) = .89, p = .42$. Figure 2 provides information about pre, post and change STAI response scores and BAS response scores for the six groups.
Cortisol Measures

Of the 59 participants involved in the study, physiological measures were assessed with 55 participants’ salivary cortisol across four time periods. Unfortunately, four of the participants’ saliva samples were not able to be examined. Results of a 2 (physical activity groups) by 3 (assigned coping strategies: association, dissociation, and control) ANOVA with repeated measures was conducted to examine the influence of physical activity level and assigned coping strategy condition for cortisol at baseline and at 15, 30 and 45 minutes post stimulus. There was no significant main effects for physical activity status, $F(3, 47) = .57, p = .64$ and assigned coping strategy, $F(6, 94) = 1.78, p = .11$. In addition, there was no significant interaction between physical activity status and assigned coping strategy, $F(6, 94) = .77, p = .60$. There was a significant difference across cortisol measurement times, $F(3, 47) = 7.32, p < .001$. Table 3 provides physical activity level and assigned coping strategy measures for anxiety, body awareness and cortisol. Based on the exit question regarding coping strategies actually used, a follow-up 2 (physical activity level) by 2 (coping strategy used: association and dissociation) ANOVA indicated no main effects for physical activity level, $F(2, 47) = .51, p = .61$, and coping strategy used, $F(4, 94) = 1.71, p = .16$, for cortisol measurement times. Likewise, there was no significant interaction between physical activity status and coping strategy used, $F(4, 94) = 1.14, p = .34$. Figure 3 provides information about the four cortisol measure times for the six groups.

Results for stress recovery indicated no significant main effects for physical activity level, $F(1, 49) = .15, p = .70$ or coping strategy used, $F(2, 49) = 2.70, p = .08$. There was no interaction between physical activity level and coping strategy used $F(2, 49) = .26, p = .77$. Results for stress recovery when looking at the exit question for participants’ coping technique used revealed the same results. No main effects for physical activity level, $F(1, 49) = .01, p = .93$, new
coping strategy, $F(2, 49) = .75, p = .48$, and no interaction between physical activity level and coping strategy used, $F(2, 49) = .74, p = .49$.

Discussion

This study is the first to examine the effects physical activity level and coping strategy have on pain tolerance including psychological and physiological stress responses in men. In addition, this is the first study to define physical activity to include both aerobic and resistance exercise. Three major results have been identified. First, contrary to expectations, less active men tolerated the acute pain longer compared to very active men. This finding not only disagrees with the research hypothesis, but also disagrees with the Cross-stressor adaptation hypothesis, suggesting physically active individuals may not perceive pain as less challenging and controllable (e.g., Sothmann et al., 1996). Second, when examining the exit coping strategy question that asked what the participants were thinking while in the pain stimulator, the majority of participants in the control condition used a type of disassociation coping mechanism to cope with the pain (e.g., singing a song, counting, or homework). In addition, men that chose to use a disassociation coping technique, independent of the coping strategy assigned to them, tolerated the acute, surface pain longer. Third, in disagreement with the hypothesis, very physically active men do not have lower stress responses in regards to lower anxiety or cortisol levels. In fact, results of this study revealed that less active men had lower anxiety and cortisol responses compared to their counterparts. Furthermore, the results of this study do not support the idea of physical activity having an effect on stress recovery.

Pain Tolerance

The result for pain tolerance confirms coping strategy effects our acute pain experience, but disagrees with what has been previously reported that focusing on acute, physical pain
effects individuals’ pain experience (Bullinger et al., 1984). Results of the current study suggests that pain tolerance is not altered by physical activity level but may be altered by the disassociation coping technique with men having higher pain tolerance. This result agrees with findings from Hwang et al. (2008) who found that when individuals focused on pain, the experience was more severe, but conflicts with Keogh et al. (2000) finding that those associating with acute pain reported less sensory pain but no coping effect was found on pain tolerance. It is unclear why physical activity level did not significantly affect the acute physical stressor. One possible explanation could be that acute bouts of physical activity performed immediately prior to acute pain results in an analgesic effect (Koltyn & Arbogast, 1998) rather than having characteristics of being physically active. However, this possible explanation needs to be taken with careful consideration because the analgesic effect was relatively short, lasting only about five minutes after resistance exercise (Koltyn & Arbogast, 1998). More research is needed to further our understanding of the effects different kinds of physical activity and coping may have on acute pain tolerance.

_Psychological stress responses._ Initial correlations for the data revealed, in general, both very physically active and less physically active men who had high state anxiety before the pain stimulator continued to have high state anxiety after the pain stimulator. However, only very physically active men who had high state anxiety scores, either before or after the pain stimulator, also had high body awareness scores. Furthermore, less active men who had high baseline cortisol levels were more likely to have high anxiety after the pain stimulator. In general, body awareness scores were slightly raised, which could indicate that men were more aware of their somatic responses to the pain stimulator, (e.g., focusing on their heart rate) rather than their actual pain; this may have diverted their attention away from the acute pain sensations.
Koltyn and Arbogast (1998) had similar conclusions, which could explain why many responses to the exit coping strategy question resulted in using a disassociation coping technique. However, body awareness responses were not found to be different between coping strategy conditions. In the current study, the very physically active control group had the highest BAS scores. This finding is in agreement with the Cross-stressor adaptation hypothesis indicating that very physically active men are familiar with the sensations of their body when under an acute painful stressor because they are familiar with stressful, painful encounters when engaging in physical activity on a daily basis (Sothmann et al., 1996). However, this finding disagrees with the previously reported results of state anxiety. If very active men were more aware of their somatic anxiety and familiar with it, their state anxiety should have been lower compared to less active men. In fact, after the stress exposure, anxiety was lower for less physically active men and the lowest when they used the association coping technique. Physical activity level does not appear to alter pain perceptions to reduce the intensity of stressors reflected by the lack of lower anxiety. Other studies have also shown that state anxiety does not change with physical activity (Koltyn & Arbogast, 1998), but it has been reported that coping mechanisms, like distraction, can significantly alter pain perception (Green et al., 2010). Unlike previous research, the distraction (i.e., disassociation) group in this study did not have altered anxiety compared to association or control groups.

Physiological stress responses. Physical activity may serve as an effective, healthy, less intrusive alternative to manage acute stressors because lab studies have found support for acute physical activity lowering cortisol with aerobic (Traustadottir et al., 2005) and resistance activity, (Koltyn & Arbogast, 1998) as well as individuals characterized with different levels of physical activity (Klaperski et al., 2012). It has been reported that there is an interaction between
neuroendocrine responses, pain perceptions, and coping mechanisms (Bullinger et al., 1984). Stress-induced rises in salivary cortisol levels have been extensively documented in numerous human studies (Dickerson & Kemeny, 2004). Typically cortisol increases when an individual is exposed to an acute, noxious stressor (Bullinger et al., 1984) and in this study, the Forgione-Barber pain stimulator was capable of producing an acute stressful state that increased cortisol levels. Salivary cortisol was found to be different across the four collection times and was related to each other, indicating that participants’ who had high baseline levels were more likely to have higher cortisol levels throughout the rest of the acute, physical stress procedure. This data does not confirm a link between physical activity level and cortisol responses because cortisol responses were actually higher for very active men versus less active men. In fact, very physically active men had higher cortisol levels before the pain stimulator which continued after the pain stimulator compared to less active men indicating that the second hypothesis was not met. This is not in line with findings from Traustadottir et al. (2005) with older women or Klaperski et al. (2012) with moderately and vigorously classified, active young women. Moreover, less active men had faster recovery with cortisol responses compared to very active men which is conflicting with the hypothesis as well as previous research (Klaperski et al., 2012). In addition, using a coping strategy did not alter cortisol responses. This report disagrees with Bullinger et al. (1984) who found that focusing on pain with an assertive coping style (i.e., association strategy) significantly reduced cortisol levels. One possible explanation may be in the nature of this study and men. Lower levels of cortisol are not expected in perceived threatening, uncontrollable stressful situations as it is in perceived familiar, controllable stressful situations (Lox et al., 2010). Individuals in this study knew they could remove their finger from the acute pain at any time, which may explain their lack of cortisol responses. The cortisol levels in this
study could reflect that this acute pain procedure was perceived as a threatening, controllable stressful situation, reflecting the stability of men. Furthermore, anticipatory cognitive appraisal processes may explain why baseline cortisol responses were elevated (Gaab et al., 2005). Moreover, relations between less active men’s baseline cortisol and their anxiety after the pain stimulator suggests that less active men who were perceiving the physical stressor as highly threatening, continued to have high anxiety after the pain stimulator compared to their counterparts. This data confirms a need for more research examining a link between physical activity level, coping strategies and cortisol responses.

Strengths and Limitations

This study is the first to examine both the psychological and physiological stress responses to an acute, pain procedure with men classified with various levels of physical activity and using different coping strategies. Majority of studies have examined physical activity to include aerobic activity while a few have examined resistance activity. In addition, this study is the first to measure physically active men’s pain tolerance with physical activity defined to include both aerobic and resistance exercise. However, participants’ using self-report measures for amount of physical activity performed is also a limitation of the current study. Previous studies have shown the Forgione-Barber pain stimulator pain procedure produce an immediate bodily reaction (Feurstein, Bush, & Corbisiero, 1981; Koltyn et al., 1999) but this study was the first to measure salivary cortisol in response to the acute, noxious stress. For this study, the pain procedure was capable of producing enough stress on the participant to create changes in anxiety and cortisol serum levels. However, anxiety and cortisol measures were not significantly different between the physically active or coping strategy groups. In addition, no pain measure was used to examine if physically active men would perceive the pain as less intense and report
lower pain intensity. Lastly, heart rate was collected throughout this study but due to hardware and program malfunctions, heart rate measures could not be assessed. More research is needed in the field and lab to investigate the psychological and physiological effects to acute physical pain as well as if physical activity and coping can effectively help reduce the psychophysiological effects.

Implications and Conclusions

Physical activity level does not appear to influence individuals’ perception to effectively tolerate acute, physical stressors longer and effectively reduce the psychophysiological response. This study concludes that coping strategies may have an impact on tolerating pain longer, specifically using a disassociation coping strategy technique but may not alter psychophysiological responses since they were unchanged with using a coping strategy. The lack of pain induced change in reduced psychological measures and cortisol levels between groups possibly reflects the stability of men with regard to acute, noxious stimulation and may not be determined by physical activity status or a coping strategy used. In conclusion, this acute pain stressor was not perceived by very physically active men in either coping strategy group as manageable, as indicated by the lack of reduced psychological stress and physiological effects compared to less active men. These unexpected results indicate more research is required in both the field and the laboratory to further our understanding of the effects physical activity and coping may have on our pain perception.
Table 1

*Descriptive Statistics of Very Physically Active and Less Active Men*

<table>
<thead>
<tr>
<th></th>
<th>Very Active</th>
<th>Less Active</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>21.00 (1.00)</td>
<td>22.00 (2.00)</td>
</tr>
<tr>
<td>Height (in)</td>
<td>70.95 (2.66)</td>
<td>71.14 (2.20)</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>187.03 (40.50)</td>
<td>207.00 (78.51)</td>
</tr>
<tr>
<td>BMI</td>
<td>26.00 (4.80)</td>
<td>28.71 (10.32)</td>
</tr>
<tr>
<td>Vigorous (min)</td>
<td>311.71 (214.60)***</td>
<td>121.43 (128.85)</td>
</tr>
<tr>
<td>Resistance (reps)</td>
<td>32.53 (10.60)***</td>
<td>16.85 (18.03)</td>
</tr>
<tr>
<td>PA Length (months)</td>
<td>51.74 (42.81)***</td>
<td>1.93 (1.87)</td>
</tr>
</tbody>
</table>

*Note.* Very physically active (Very Active) is reported as the average self-reported amount of physical activity (PA) performed in a week. PA length is the length of time the reported physical activity was performed. *Note.* *p* < 0.05 compared with less active, **p* < 0.01 compared with less active, ***p* < 0.001.
Table 2

*Very Physically Active and Less Physically Active Correlations*

<table>
<thead>
<tr>
<th></th>
<th>STAI pre</th>
<th>STAI post</th>
<th>STAI diff</th>
<th>BAS</th>
<th>Time</th>
<th>Baseline</th>
<th>Post 15</th>
<th>Post 30</th>
<th>Post 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAI pre</td>
<td>-</td>
<td>.76**</td>
<td>-.11</td>
<td>.43**</td>
<td>-.12</td>
<td>-.11</td>
<td>.03</td>
<td>-.13</td>
<td>-.24</td>
</tr>
<tr>
<td>STAI post</td>
<td>.50*</td>
<td>-</td>
<td>.56**</td>
<td>.53**</td>
<td>-.14</td>
<td>-.13</td>
<td>.06</td>
<td>-.04</td>
<td>-.19</td>
</tr>
<tr>
<td>STAI diff</td>
<td>-.50</td>
<td>.50*</td>
<td>-</td>
<td>.27</td>
<td>-.06</td>
<td>-.05</td>
<td>.05</td>
<td>.11</td>
<td>.01</td>
</tr>
<tr>
<td>BAS</td>
<td>.14</td>
<td>.36</td>
<td>.24</td>
<td>-</td>
<td>-.11</td>
<td>-.30</td>
<td>-.10</td>
<td>-.17</td>
<td>-.27</td>
</tr>
<tr>
<td>Time</td>
<td>.08</td>
<td>.29</td>
<td>.20</td>
<td>.18</td>
<td>-</td>
<td>.04</td>
<td>.22</td>
<td>.19</td>
<td>.17</td>
</tr>
<tr>
<td>Baseline</td>
<td>.17</td>
<td>.50*</td>
<td>.33</td>
<td>.38</td>
<td>.13</td>
<td>-</td>
<td>.85**</td>
<td>.87**</td>
<td>.84**</td>
</tr>
<tr>
<td>Post 15m</td>
<td>.15</td>
<td>.29</td>
<td>.14</td>
<td>.22</td>
<td>.11</td>
<td>.68**</td>
<td>-</td>
<td>.92**</td>
<td>.84**</td>
</tr>
<tr>
<td>Post 30m</td>
<td>.24</td>
<td>.42</td>
<td>.17</td>
<td>.30</td>
<td>.12</td>
<td>.77**</td>
<td>.93**</td>
<td>-</td>
<td>.93**</td>
</tr>
<tr>
<td>Post 45m</td>
<td>.21</td>
<td>.38</td>
<td>.17</td>
<td>.37</td>
<td>.12</td>
<td>.69**</td>
<td>.67**</td>
<td>.84**</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note.* Tolerance time (Time) in the acute pain stimulator and psychophysiological measures are provided. Psychological measures include the State Trait Anxiety Inventory mean score before (STAI pre) and after (STAI post) the pain stressor as well as the Body Awareness Scale (BAS) mean score. In addition, the STAI difference (STAI diff) score is provided. Physiological measures include cortisol mean scores at baseline and 15 minutes, 30 minutes, and 45 minutes post pain stimulus. Top portion of the table includes psychophysiological measures for very active men whereas the bottom portion of the table shows less active men measures. *p < 0.05 and **p < 0.01.
Table 3

**Physical Activity and Coping Condition Psychophysiological Measures**

<table>
<thead>
<tr>
<th></th>
<th>Very Active</th>
<th>Less Active</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Association</td>
<td>Disassociation</td>
<td>Control</td>
<td>Association</td>
</tr>
<tr>
<td>Time</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td></td>
<td>226.25 (123.99)</td>
<td>217.31 (144.78)</td>
<td>251.77 (130.86)</td>
<td>259.67 (123.99)</td>
</tr>
<tr>
<td>STAI pre</td>
<td>28.83 (8.31)</td>
<td>29 (6.26)</td>
<td>27.62 (5.50)</td>
<td>36.17 (7.65)</td>
</tr>
<tr>
<td>STAI post</td>
<td>30.25 (5.20)</td>
<td>30 (7.69)</td>
<td>30.62 (7.85)</td>
<td>32.17 (8.13)</td>
</tr>
<tr>
<td>STAI diff</td>
<td>1.41 (5.41)</td>
<td>1.00 (5.60)</td>
<td>3.00 (4.56)</td>
<td>-4.00 (7.38)</td>
</tr>
<tr>
<td>BAS</td>
<td>20.75 (2.63)</td>
<td>20.38 (3.62)</td>
<td>22.15 (3.67)</td>
<td>20.67 (2.07)</td>
</tr>
<tr>
<td>Baseline</td>
<td>10 (10.83)</td>
<td>9.14 (4.67)</td>
<td>11.01 (4.64)</td>
<td>9.31 (7.34)</td>
</tr>
<tr>
<td>Post 15m</td>
<td>9.56 (8.48)</td>
<td>9.31 (5.08)</td>
<td>12.82 (4.99)</td>
<td>9.26 (6.28)</td>
</tr>
<tr>
<td>Post 30m</td>
<td>7.71 (5.72)</td>
<td>7.75 (4.29)</td>
<td>10.02 (4.25)</td>
<td>8.30 (5.69)</td>
</tr>
<tr>
<td>Post 45m</td>
<td>7.76 (4.62)</td>
<td>8.00 (2.99)</td>
<td>7.85 (2.92)</td>
<td>7.17 (4.83)</td>
</tr>
</tbody>
</table>

*Note.* Physical activity status (very active vs. less active) and coping strategy (association, disassociation and control) condition tolerance time (Time), psychological and physiological measures. Psychological measures include the State Trait Anxiety Inventory mean scores before (STAI pre) and after (STAI post) the pain stressor as well as the Body Awareness Scale (BAS) mean scores. In addition, the STAI difference (STAI diff) score is provided. Physiological measures include cortisol mean scores at baseline and 15 minutes, 30 minutes, and 45 minutes post pain stimulus.
Figure 1. Pain tolerance

Note. Mean pain tolerance time (in seconds) for very physically active (VPA) and less physically active (LPA) groups as well as association, disassociation, and control conditions. Error bars denote one standard deviation around the mean.
Figure 2. Psychological measures

Note. Mean anxiety from the State Trait Anxiety Inventory (STAI) for very physically active (VPA) and less active groups (LPA) as well as association, disassociation and control conditions. Mean STAI change scores are also represented (STAI difference). Mean body awareness scores from the body awareness scale for VPA and LPA groups as well as association, disassociation and control conditions. Error bars denote one standard deviation around the mean.
Figure 3. Salivary Cortisol

Note. Mean cortisol (in nmol/L) measured at baseline, post 15 min., post 30 min., and post 45 min. for very physically active (VPA) and less physically active (LPA) along with association, disassociation and control conditions.
APPENDIX A

CLASSROOM ANNOUNCEMENT SCRIPT
Hi, my name is Grace and I would like to interest you in being a participant in my study. If you are interested in research or wanting to learn about the effects of stress and how you individually perceive stress then please contact me to get more information about signing up for my study.

The purpose of this study is to examine differences between physically active and non-active men’s pain tolerance responses when using coping strategies while engaged in an acute physical stress procedure.

I need men that are between the ages of 18-26 who do not currently suffer from chronic pain, do not have any history of cardiovascular disease or diabetes, and are not currently on any medications.

Your saliva will be collected at four different times along with heart rate while engaged in an acute pain stressor to the non-dominant forefinger.

You will need to be available to come to the lab anytime between 3-6p.m. You will only come to the lab once and it will only take about 40 minutes of your time. Are there any questions? Thank you for your time
APPENDIX B

INFORMED CONSENT
University of North Texas Institutional Review Board

Informed Consent Notice

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: Physiological and Psychological Effects of an Acute Stressor: Comparing Coping Strategies among Physically Active and Non-active Adults

Student Investigator: Grace A Brandt, University of North Texas (UNT) Department of Kinesiology, Health Promotion and Recreation. Supervising Investigator: Dr. Scott Martin

Purpose of the Study: You are being asked to participate in a research study which will examine men tolerating pain and their responses. The purpose of the current study is to examine men’s pain tolerance while engaged in an acute noxious stress procedure. Additionally, we will be examining salivary cortisol, heart rate variability, anxiety, and body awareness responses to the acute noxious stressor.

Study Procedures: On your first visit, you will be asked to provide consent and background information. Based upon your responses to the questionnaires, the investigator will determine if you are eligible to continue in the study and schedule a time to come to the lab between 3 - 6pm. The time for consent, background information and scheduling will take about 10 minutes of your time. On the day of testing, 1) do not brush your teeth or eat a meal two hours prior to coming to lab; 2) do not engage in physical activity on the day of study; and 3) do not intake any form of caffeine on day of study.

On your second visit, you will arrive at your scheduled time to the applied physiology laboratory PEB 109. To begin the study, you will have a quiet rest time and fill out a couple questionnaires. Once you complete the questionnaires, we will collect a saliva sample by having you chew on a cotton swab. You will then place your finger into the chute of the pain stimulator and be instructed to keep it there for as long as you can. At the time you indicate you can no longer tolerate the pain, remove your finger from the pain stimulator. You will then complete two questionnaires and we will collect a second and third saliva sample. A recovery time of ten minutes and a final saliva sample will conclude the study. Your time in the lab will take about 55 minutes. Total time for this study including both visits is 65 minutes.

Foreseeable Risks: You will feel pain or discomfort to the non-dominant forefinger when it is in the surface pain stimulator. Additionally, there is a slight risk of your finger being injured such as an indentation on your forefinger for a couple of days. To limit the risk of damage, you are to remove your finger when you can no longer tolerate the pain.

Benefits to the Subjects or Others: There are no direct benefits to you. We hope to learn more about factors that influence pain perceptions and tolerance.

Compensation for Participants: None
Procedures for Maintaining Confidentiality of Research Records: Surveys and data will be anonymous, and we will not report your name or any personal identification information. Participation numbers will be used to code the questionnaires and saliva samples. The confidentiality of your individual information will be maintained in any publications or presentations regarding this study. All investigators, professional staff, and technicians are aware of the confidentiality involved with this study and have completed the confidentiality training required by the University. Surveys and saliva data will be stored in a locked office (BGYM 206). Surveys will be kept for three years after the completion of the study and then shredded.

Questions about the Study: If you have any questions about the study, you may contact Grace Brandt at grace.brandt@unt.edu or Dr. Scott Martin, at scott.martin@unt.edu

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants’ Rights:
Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- Grace Brandt has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study or authorize use and disclosure of your health information, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- Your decision whether to participate or withdraw from the study will have no effect on your grade or standing in any UNT course.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study. You also consent to use of your health information in this study.
- You have been told you will receive a copy of this form.

Printed Name of Participant

________________________________                                ____________         Signature of Participant

Participant                                      Date
APPENDIX C

THESIS ANNOUNCEMENT FLYER
Male participants needed!

The Kinesiology Health Promotion and Recreation department invites you to participate in the research study of:

Physiological and Psychological Effects of an Acute Stressor: Comparing Coping Strategies among Physically Active and Non-active Adults

Qualification include:

- Men that are between the ages of 18-26
- Do not currently suffer from chronic pain
- Do not have any history of cardiovascular disease or diabetes
- Are not currently on any medications
- Available between 3 and 6pm

Sign up for this study!

This study only requires one session of 40 minutes. If you are interested or have questions regarding this study, please contact: Grace Brandt at grace.brandt@unt.edu or 940.565.2965
APPENDIX D

DEMOGRAPHIC/ PHYSICAL ACTIVITY QUESTIONS
I. Background Information

1. Last four digits of your Student ID #_______

2. Age: _____ yrs.

3. How tall are you? ____________ feet _____________ inches

4. How much do you weigh now? _____________ pounds

5. Ethnicity Category (based on US Census Bureau):
   - □ Hispanic, any race
   - □ White, non-Hispanic
   - □ Black, non-Hispanic
   - □ Asian and Pacific Islander
   - □ American Indian and Alaska American
   - □ Other __________________________

6. What is your marital status?
   - □ Single
   - □ Married
   - □ Divorced
   - □ Widowed

7. What is currently your college major?
   - □ Kinesiology
   - □ Music
   - □ Health Promotion
   - □ Undecided
   - □ Recreation and Leisure Studies
   - □ Other __________________________
   - □ Psychology

II. Medical History Questionnaire

Subjects who answer yes to any questions between 10 and 21 are excluded from participating in the study because exercise would not be advised.

The purpose of this questionnaire is to obtain information about your medical history. It is important that you answer each question honestly and completely in order to minimize the risks associated with your participation in this research. Please ask us if you need clarification about any of the questions. Put a question mark (?) next to any questions that you are not certain about.

1. _________ Do your mother or father have high blood pressure (i.e., hypertension)?
2. _________ Do you now have, or have you ever had, any heart trouble?
3. _________ Do you frequently suffer from pains in your chest?
4. _________ Do you often feel faint or have spells of severe dizziness?
5. _________ Do you have a bone or joint problem, such as arthritis?
6. _________ Do you regularly smoke cigarettes?
7. _________ Have you ever had an unexplained episode of irregular heartbeats, trembling, sweating, difficulty breathing or intense anxiety.

8. _________ Do you have any pain that you have been experiencing for more than a month?

### III. Physical Activity History

We are interested in two types of physical activity – **cardiorespiratory and resistance**.

- **Vigorous**: activities that cause large increases in breathing or heart rate
- **Moderate**: activities that cause small increases in breathing or heart rate.

#### Cardiorespiratory Exercise

- Adults should get at least 150 minutes of moderate-intensity exercise per week.
- Exercise recommendations can be met through 30-60 minutes of moderate-intensity exercise (five days per week) or 20-60 minutes of vigorous-intensity exercise (three days per week).
- One continuous session and multiple shorter sessions (of at least 10 minutes) are both acceptable to accumulate desired amount of daily exercise.

**About how much moderate cardiorespiratory activity do you do in a week?**

1. Do you do moderate cardiorespiratory activities for 30-60 minutes for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes some increase in breathing or heart rate?
   - Yes, ________ hours _________ minutes each day
   - No
   - Not Sure, about ________ hours _______ minutes each day

2. **How many days per week do you do these moderate activities for at least 10 minutes at a time?**
   - 0
   - 1
   - 2
   - 3

3. **Moderate cardiorespiratory total: ______ hours _____ minutes X _____ days = _____**

**About how much vigorous cardiorespiratory activity you do in a usual week?**

4. Do you do vigorous cardiorespiratory activities for 20-60 minutes at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?
   - Yes, ________ hours _________ minutes each week
   - No
Not Sure, about _____ hours _____ minutes each week

5. How many days per week do you do these **vigorous** cardiorespiratory activities for at least 10 minutes at a time?
   - [ ] 0
   - [x] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

6. **Vigorous** cardiorespiratory total: _____ hours _____ minutes X _____ days = _____ for _____ years OR _____ months

**Resistance Exercise**

- Adults should train each major muscle group two or three days each week using a variety of exercises and equipment.
- Two to four sets of each exercise will help adults improve strength and power.
- For each exercise, 8-12 repetitions improve strength and power and 15-20 repetitions improve muscular endurance.

7. During the past week, how many **times per day** did you do resistance physical activities or exercises to STRENGTHEN your muscles? Do NOT count aerobic activities like walking, running, or bicycling. Count activities using your own body weight like yoga, sit-ups or push-ups and those using weight machines, free weights, or elastic bands.
   - [ ] 0
   - [x] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5
   - [ ] 6
   - [ ] 7

8. When you do resistance physical activities, how many repetitions do you for each set?
   - [ ] 5
   - [ ] 6
   - [x] 7
   - [ ] 8
   - [ ] 9
   - [ ] 10
   - [ ] 11
   - [ ] 12+

9. When you do resistance physical activities, how many sets do you do?
   - [ ] 0
   - [x] 1
   - [ ] 2
   - [ ] 3
   - [ ] 4
   - [ ] 5

10. How long have you been doing resistance physical activities?
    ____________ years OR ________ months

REFERENCES


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