Muscle Up: Psychobiological Responses to Social-Evaluative Body Image Threats in University Male Athletes and Non-Athletes

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DEDICATION

This thesis is dedicated to my late father and brother: How I wish you could still be with us. This thesis also dedicated to my mother and husband: Thank you for your continued and unwavering support.

ABSTRACT

Negative body image often occurs as a result of social evaluation of the physique in men. However, athletes tend to experience fewer body image concerns compared to non-athletes. Social-self preservation theory (SSPT) holds that social-evaluative threats (SETs) elicit consistent psychobiological responses (salivary cortisol and shame) to protect one's social-esteem, status, and standing. Actual body image SETs have shown consistent psychobiological changes consistent with SSPT in men, however, these responses in athletes have yet to be examined due to the unique relationship they have with their bodies. Thus, the purpose of the current study was to examine psychobiological (i.e., body dissatisfaction and shame and salivary cortisol) responses to an acute laboratory body image SET in 49 male varsity athletes and 63 non-athletes from a university community between the ages of 18 and 28 years old. Participants were randomized into a high or low body image SET conditions, stratified by athlete status, and measures of body dissatisfaction and shame and salivary cortisol were taken across the session. Results showed significant time-by-condition interactions, such that athletes and non-athletes had significant increases in salivary cortisol, when controlling for baseline values, and state body shame following the high-threat condition only. Consistent with SSPT, body image SETs led to increased state body shame and salivary cortisol, although there were no differences in these responses between university non-athletes and university male athletes from non-aesthetic sports. By contrast, previous studies have found that elite level athletes showed blunted psychobiological responses to performance based SETs compared to non-exercisers. It is possible that athletes in the present study did not compete at a high enough level to reduce the effects of SETs; it is also possible that differences in sport type between the athletes in the current study and those in previous studies may explain differences in findings. It is also possible that body image threats lead to unique responses compared to more general, performance-based threats. Future research should continue to examine the relationship between athletes and their body image by investigating the impact of competition level and sport type within a Canadian university sport context.

Keywords: Athletes, Cortisol, Body Dissatisfaction, Body Shame, Men, Social-Self Preservation Theory

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CHAPTER 1: LITERATURE REVIEW

1.1 Body Image

The term body image was first defined by Dr. Paul Schilder (1935) as the perception and form of a person's body in his/her own mind (Slade, 1994). The term body image has since evolved and is defined as a multidimensional construct involving both the perceptions and attitudes about the physical appearance and functionality of the body (Cash, 2012). The perceptual dimension refers to the ability to accurately view and judge the size and shape of various body parts and the body as a whole, while the attitudinal dimension includes thoughts, feelings, and behaviours reflecting appearance evaluation and orientation (Banfield & McCabe, 2002; Muth & Cash, 1997; Slade, 1994; Tiggemann, 2011). Appearance evaluation denotes the satisfaction or dissatisfaction with the body, whereas appearance orientation is the affective, cognitive, and behavioural investment or importance placed on the body (Brown, Cash, & Mikulka, 1990; Cash, 2012; Muth & Cash, 1997).

The affective component of body image refers to the emotions about the body's appearance and functionality (Cash, 2012). These emotions can be either positive (e.g., pride, esteem, happiness) or negative (e.g., shame, embarrassment, anxiety), and they are both dynamic (i.e., can change daily) and stable (i.e., can remain the same over the long-term). The cognitive component of body image refers to the thoughts and beliefs about the body's appearance and functionality. The behavioural component involves the actions and behaviours performed that reflect the perceptions, thoughts, and feelings about the body, such as dieting, body checking behaviours, grooming, body exposure avoidance, and exercise-related behaviours (Cash, 2012).

1.2 Men's Body Image

Negative body image is characterized by negative perceptions of, or attitudes towards, the body, such as excessive dissatisfaction or appearance orientation (Cash, 2011). Historically, negative body image has focused on the inaccurate and negative perceptions of the body and its parts (e.g., overestimates of body size), however, in the early 2000s, a call for research focusing on the attitudinal components shifted the attention of body image researchers (Cash, 2004). Moreover, while negative body image researchers have primarily focused on young adult Caucasian women, more recent research examining and comparing ethnic (Boisvert & Harrell, 2012; Bruns & Carter, 2015; Dye, 2016), gender (Dye, 2016; Griffiths et al., 2016; Karazsia, Murnen, & Tylka, 2017), sexual orientation (Frederick & Essayli, 2016; Morrison & McCutcheon, 2011), and age (Dye, 2016) groups has provided evidence to support the idea that negative body image is a universal concern in Western culture (Morrison & McCutcheon, 2011). For example, while women do experience high levels of negative body image, studies have shown that men are not immune to the societal pressures to adhere to unrealistic body standards (Fiske, Fallon, Blissmer, & Redding, 2014). Despite this evidence, men have relatively been neglected in the body image literature compared to women.

Western society's body standards for men are to be tall, have broad shoulders, a thin waist, large arms, noticeable and prominent abdominal muscles, to be strong, and most importantly, to be muscular and lean (Tiggemann, 2011). This body standard has been labelled the *muscular ideal*. The *muscular ideal* is typically perpetuated by family and peers and through popular media, such as social media, video games, magazines, and TV shows and movies (Ata, Ludden, & Lally, 2007; Fatt, Fardouly, & Rapee, 2019; Franchina &

Coco, 2018; Tiggemann, 2011). The ideal male body has not only increased in its exposure within Western society, but has also become increasingly exaggerated in its muscular depiction throughout the past several decades (Dotson, 1999; Leit, Gray, & Pope, 2002; Pope, Olivardia, Gruber, & Borowiecki, 1999).

1.2.1 Body dissatisfaction. Body dissatisfaction is a cognitive-affective component of body image and has commonly been used as a general measure of negative body image. Body dissatisfaction occurs when an individual experiences a perceived discrepancy between their internal body representation and society's body ideal. The prevalence of body dissatisfaction has been estimated to be between 9 – 28% in men and varies due to many factors such as age, ethnicity, and body mass index (BMI; Fallon, Harris, & Johnson, 2014).

Many factors contribute to the development of body dissatisfaction in men. For example, a longitudinal study by Paxton, Eisenberg, and Neumark-Sztainer (2006) found that adolescent boys with higher levels of depression, BMI and weight teasing, and lower self-esteem and socioeconomic status were more likely to develop body dissatisfaction as young adults. Higher levels of body dissatisfaction have been linked with lower self-esteem (van den Berg, Mond, Eisenberg, Ackard, & Neumark-Sztainer, 2010), higher body checking behaviours (Walker, Anderson, & Hildebrandt, 2009), exercise dependence (Müller, Loeber, Söchtig, Te Wildt, & De Zwaan, 2015), anabolic steroid abuse (Walker et al., 2009), and general psychological distress (Griffiths et al., 2016) in men.

1.2.3 Body shame. Body shame, which is shame directed towards one's physical appearance and body functionality, is a powerful negative self-conscious emotion. It occurs when an individual experiences a perceived failure to meet an internalized stable attribute, such as meeting societal body image ideals, leading to a global sense of failure. Body shame is another measure of negative body image and has been significantly correlated with body dissatisfaction (Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002), muscle dysmorphia (Pope et al., 2005), appearance anxiety (Hallsworth, Wade, & Tiggemann, 2010), self-objectification (Hallsworth et al., 2010), and sexual dysfunction (Davison & McCabe, 2005) in men.

1.3 Physical Activity and Body Image

There are many well-documented psychological benefits associated with both acute and chronic (regular) exercise, such as increased levels of positive affect (Kwan & Bryan, 2010; Reed & Buck, 2009; Reed & Ones, 2006), mental well-being (Fox, 1999), global self-esteem (Fox, 1999), and decreased levels of anxiety, neuroticism, and depression (De Moor, Beem, Stubbe, Boomsma, & De Geus, 2006; Rebar et al., 2015; Ströhle, 2009).

Significant research has documented the positive effects of physical activity on various aspects of body image. In a meta-analysis, Hausenblas and Fallon (2006) demonstrated that individuals who engaged in regular exercisers had less negative subjective feelings and evaluations about the body, and engaged in fewer behaviours indicative of negative body image (e.g., body checking behaviours) compared to those who engaged in low-to-no amounts of exercise. Meta-analyses by Campbell and Hausenblas (2009), and Reel et al. (2007) demonstrated that exercise programs prescribing moderate-to-vigorous intensity workouts could decrease body image concerns (e.g., body [dis]satisfaction, social physique anxiety) , regardless of sex or age. Further, Bassett-Gunter, McEwan, and Kamarhie (2017) also found low-to-moderate intensities of physical activity were effective in decreasing body dissatisfaction in men. While there were mixed results regarding which type of exercise was most effective, both aerobic and anaerobic exercise demonstrated positive effects on body dissatisfaction.

1.3.1 Sport and body image. Though the literature on body image in athletes continues to indicate a complex relationship, meta-analytic reviews (Chapman & Woodman, 2016; Hausenblas & Symons Downs, 2001; Varnes et al., 2013) and studies (Abbott & Barber, 2011; Galli & Reel, 2009) demonstrate that generally, athletes experience less negative body image (i.e., negative subjective self-evaluation, body shape dissatisfaction, more accurate perceptions of the body) compared to non-athletes, regardless of sex. Specifically, Hausenblas and Symons Downs (2001) demonstrated that body dissatisfaction differences between athletes and non-athletes were equal between sexes. Additionally, Hausenblas and Symons Downs (2001) showed that high-level college athletes had significantly less negative body dissatisfaction compared to recreational athletes, exercisers and non-exercisers. These findings were further supported by a systematic review by Varnes et al. (2013) who documented that female athletes report higher levels of body esteem (i.e., physical conditioning, weight concern, sexual attractiveness) and body satisfaction compared to their non-athlete counterparts.

When examining sport type, however, the results of research have been more inconsistent. Hausenblas and Symons Downs (2001) found no significant differences in body dissatisfaction between athletes in different types of sport (i.e., aesthetic, endurance, ball game), regardless of sex. By contrast, Varnes et al. (2013) demonstrated that female athletes in appearance-focused sports (i.e., gymnastics and tennis) had lower levels of body esteem and body satisfaction compared to athletes in non-appearance-focused sports (i.e., basketball, soccer, softball, track & field, and volleyball). Specifically in men, a meta-analysis by Chapman and Woodman (2016) documented that there was no significant difference in disordered eating (i.e., subclinical eating disorder symptomatology, including drive for thinness) between male athletes of different competition levels or between male athletes and non-athletes. Regarding sports type, male athletes from endurance and aesthetic sports did not seem to differ in their level of disordered eating compared to their non-athlete counterparts. However, male wrestlers reported greater disordered eating compared to their non-athlete controls, although there were no significant differences in disordered eating between athletes from other weight-dependent sports, such as martial arts, and their non-athlete counterparts. Together, these studies indicate a complex relationship between body image and disordered eating patterns in athletes. Additionally, they serve to highlight the inconsistencies surrounding how sports are classified within body image research. It should be noted that while many different body image measures have been used between studies, many of the measures used assess drive for thinness and do not assess more relevant body image issues for men, such as the drive for muscularity or internalization of the muscular ideal. Further, they have generally not assessed other body image components such as body-related shame.

While research has shown conflicting findings regarding body image concerns in athletes, these studies highlight the unique relationship that athletes have with their bodies. Abbott and Barber (2011) found that functional body values (i.e., the value placed on the body as a functional tool), satisfaction and behavioural investment were higher in females who participated in sport compared to non-exercisers. Aesthetic values and investment (i.e., the value and importance placed on the body's appearance) were found to also be higher in female athletes. Additionally, Lunde and Gattario (2017) found that female athletes struggled between having a body that emphasized performance versus having a body that emphasized appearance. Moreover, Galli and Reel (2009) found that male athletes, while not placing a great deal of importance on their physique and being quite satisfied with their bodies' appearance, still tended to compare their physiques to those of their teammates, competitors, and to professionals on TV. These athletes also felt additional pressure from coaches, teammates, friends and society to have the ideal athletic body (Galli & Reel, 2009).

Thus, while sports participation can serve as a protective factor against body image concerns for many individuals, body-related pressures still exist for athletes. Moreover, athletes may feel additional pressures to uphold the muscular ideal due to the physical requirements of their sport from a society that may have higher functional and appearance expectations for athletes. These pressures can lead to higher levels of body dissatisfaction (Galli & Reel, 2009; Myers & Crowther, 2009), steroid use (Lorang, Callahan, Cummins, Achar, & Brown, 2011; Sagoe, Molde, Andreassen, Torsheim, & Pallesen, 2014) and disordered eating (Chapman & Woodman, 2016; DiPasquale & Petrie, 2013) as a way of attaining the unrealistic muscular ideal.

1.4 Social Self-Preservation Theory (SSPT)

As social creatures, humans have an innate need to belong to a group and to be viewed favourably by others. Social self-preservation theory (SSPT) suggests this social-self is essential (Kemeny, Gruenewald, & Dickerson, 2004) and that when a threat to the social-self is present (i.e., social-evaluative threat), self-conscious emotions (i.e., shame) are elicited followed by activation of the hypothalamus-pituitary-adrenal (HPA) axis (i.e., cortisol). These psychobiological responses warn the individual of the potential threat so they can engage in actions (appeasement, withdrawal, avoidance) to reduce the threat

(Dickerson, Gruenewald, & Kemeny, 2004; Dickerson & Kemeny, 2004; Kemeny et al., 2004).

Social-evaluative threats (SETs) are psychosocial stressors (imaginary, potential, or actual) that may reduce or damage an individual's social esteem, standing, and/or status (Kemeny et al., 2004) by calling into question their abilities and/or competencies (Kemeny et al., 2004). In a meta-analysis of 208 studies, Dickerson and Kemeny (2004) examined the effect of acute laboratory stressors on cortisol responses. They reported that stressors that involved social evaluation, where the outcome of the task was uncontrollable (i.e., participants would perform poorly on the task no matter what), that involved a permanent record (e.g., videotaping), and that involved characteristics of importance to the individual yielded the greatest cortisol response (Dickerson & Kemeny, 2004).

A significant body of literature has utilized the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993) to induce psychosocial stress. In this, participants are given 5 minutes to prepare and deliver a 5-minute speech in front of a panel of judges, followed by a series of mathematical problems. Consistently, the TSST leads to increases in shame and cortisol, consistent with SSPT.

1.4.1 Shame. Self-conscious emotions, such as shame, pride, embarrassment, and guilt, are complex emotions that evolve from primary emotions, such as sadness, joy, and fear (Tracy & Robins, 2004). Self-conscious emotions require self-reflection and evaluation. Shame is a powerful negative self-conscious emotion, characterized by a desire to escape, hide, or disappear and typically occurs in response to a self-perceived transgression of an internalized social standard leading an individual to feel like he/she is a failure (i.e., global; Keltner, 1996; Lewis, 2008; Sabiston et al., 2010). Shame is distinctly different from other self-conscious emotions and has been associated with more physiological changes (e.g., increased cortisol reactivity, heart rate, blushing) compared to guilt and embarrassment (Tangney, Miller, Flicker, & Barlow, 1996). Within the context of the SSPT, shame is elicited when a key aspect of the self is, or could be, judged as inadequate (Dickerson et al., 2004). Shame has been linked to body dissatisfaction (Fallon et al., 2014), appearance anxiety (Monro & Huon, 2005), and chronically associated with disordered eating in sexual minority men (Wiseman & Moradi, 2010), sexual dysfunction (Calogero & Thompson, 2009), increased levels of depression (Kim, Thibodeau, & Jorgensen, 2011), glucocorticoid sensitivity and biologically active inflammatory markers (Rohleder, Chen, Wolf, & Miller, 2008).

1.4.2 Cortisol. Cortisol is a stress hormone and is the end product of the HPA axis. Following exposure to stressors, the hypothalamus releases corticotropin-releasing hormone (CRH) into the bloodstream. When the anterior pituitary gland is stimulated by CRH, it triggers the release of adrenocorticotropic hormone (ACTH), which is then secreted into the bloodstream and stimulates the release of cortisol, a glucocorticoid, from the zona fasciculata of the adrenal cortex, within the adrenal gland.

Cortisol is a fat-soluble steroid hormone whose main function is to increase blood glucose levels. Increases in blood glucose levels mobilize energy reserves in the body. Further, increases in circulating cortisol signals the HPA axis to stop releasing CRH. This negative feedback loop helps to regulate circulating cortisol; however, if stressors persist, the hypothalamus will continue to secrete CRH regardless of elevated circulating cortisol levels. While an acute cortisol response to stressful stimuli is be adaptive and necessary for survival, chronic, excessive, or inappropriate cortisol secretion has been linked to serious psychological and physiological consequences, including the suppression of some immune system functioning leading to the progression of diseases such as HIV (Dickerson et al., 2004), increased pro-inflammatory cytokines in blood serum (Dickerson et al., 2004; Georgiades, 2007), neuronal atrophy of the prefrontal cortex and hippocampus (Arnsten, 2009), cardiac and vascular hypertrophy (Lovallo & Gerin, 2003), and hypertension (Krantz & Manuck, 1984).

1.4.3 Athlete status. Several studies have investigated psychobiological responses to non-body image SETs in athletes. In a five-part study, Rohleder, Beulen, Chen, Wolf, and Kirschbaum (2007) examined the psychobiological responses (i.e., perceived stress and cortisol) of ballroom dancers of varying experience levels, in competition, in training, and during a standardized laboratory psychosocial stressor (i.e., TSST). Rohleder et al. (2007) found significantly higher levels of salivary cortisol and perceived stress on competition day compared to non-training and training days, regardless of experience level of the dancers. Additionally, cortisol levels were significantly higher in the single dancer competition compared to group dancer competitions, possibly due to the judges' attention being diluted between multiple dancers in the group competition. They also found that the ballroom dancers' cortisol levels were no different compared to those of university students in response to a standard laboratory social stressor (i.e., TSST). Additionally, they found that the dancers experienced significantly higher levels of cortisol during competition compared to the laboratory stressor. Rohleder et al. (2007) concluded that real-life stressors were more effective at inducing a psychobiological response compared to laboratory stressors. However, the physical activity levels of the students in the TSST were not measured and therefore the similar responses may have been due to an active student sample that had blunted biological responses, similar to the dancers.

Rimmele et al. (2007) explored male athletes' psychobiological responses (i.e., anxiety, calmness, mood, heartrate, and cortisol) to the TSST compared to non-active men. Athletes were men who competed in endurance sports at a national level, while non-active men were defined as individuals who participated in two or fewer hours of exercise per week. Results showed the athletes had lower heartrates and salivary cortisol compared to the untrained individuals in response to the TSST. They also found that mood and anxiety significantly worsened in the untrained men, while the athletes exhibited no changes in mood and anxiety following the stressor. The authors concluded that highly trained individuals show blunted psychobiological responses to SETs. However, they also noted that these results may not generalize to athletes who compete at lower levels of competition, and that they could not distinguish between the effect of sport and physical activity level.

A second study by Rimmele et al. (2009) looked at differences in psychobiological responses to the TSST in elite sportsmen, amateur sportsmen, and non-active men. All athletes were medium to long distance runners; the classification of elite and amateur sportsmen was based on self-reported physical activity and training levels, with elite sportsmen having roughly double the amount of training, running hours, and running distance per week compared to the amateur sportsmen. Additionally, elite sportsmen had significantly greater submaximal running velocity and anaerobic threshold compared to the amateur sportsmen. Rimmele et al. (2009) found that elite sportsmen had significantly lower salivary cortisol, heartrate, and state anxiety compared to the non-active individuals and amateur sportsmen in response to the TSST. While the amateur sportsmen had significantly lower heartrate compared to the non-active control group, there were no significant differences in salivary cortisol or state anxiety levels between these groups. Furthermore, while mood and calmness worsened as a result of the stressor for all groups, there were no significant between group differences observed. Rimmele et al. (2009) concluded that elite sportsmen showed reduced psychobiological responses to psychosocial stress, in the form of lower anxiety, heartrate, and salivary cortisol compared to non-active individuals and amateur athletes.

Though these studies suggest that elite athletes exhibit blunted psychobiological responses to psychosocial stress compared to amateur sportsmen and non-athletes, they neglected to measure changes in shame, which is the key emotional component of SSPT. Additionally, elite and amateur sportsmen were athletes from endurance-based sports only and were separated primarily based on cardiorespiratory fitness rather than competition level. Therefore, these findings may not reflect all athletes or athletes who compete at different levels of competition. Furthermore, different social-evaluative stressors may be more salient and evoke different psychobiological responses compared to those examined using TSST. For example, social evaluation of the physique may cause different psychobiological responses.

1.4.4 Body image. As noted previously, psychosocial stressors on characteristics of importance, that are uncontrollable and involve social comparison and evaluation, have the potential to evoke psychobiological stress responses (Kemeny et al., 2004). Physical appearance is one characteristic that is very important to many individuals, especially university students who are more likely to suffer from higher levels of body dissatisfaction compared to the general population (Fiske et al., 2014; Neighbors & Sobal, 2007). Further, body-specific SETs have the potential to occur daily. Therefore, due to the frequency with which social comparisons of the physique are likely to occur in everyday life and the importance placed on appearance in young adult men, it is important to investigate the potential impact that social-evaluative body threats have in this population. To date, several studies have examined psychobiological responses of body specific SETs consistent with SSPT, although the majority have focused on non-athlete university females (Cloudt, Lamarche, & Gammage, 2014; Lamarche, Gammage, Klentrou, Kerr, & Faulkner, 2014; Lamarche, Kerr, Faulkner, Gammage, & Klentrou, 2012; Lamarche, Gammage, Kerr, Faulkner, & Klentrou, 2016; Martin Ginis, Strong, Arent, & Bray, 2012).

In general, studies examining shame and cortisol responses to body image SETs are consistent with the other SSPT literature. Martin Ginis et al. (2012) conducted two experiments examining the effects of anticipatory body image SETs in university women. In the first experiment, the researchers told half of the participants that they would be working out in a public exercise facility at the university while wearing revealing exercise apparel and being videotaped by a male research assistant. The other half of the participants were told that they would be working out alone in a private exercise facility while wearing baggy clothing. No video camera would be present in the control condition and no mention of the camera occurred during testing. In the second experiment, the researchers told half the participants that they would be trying on revealing exercise apparel and modeling it to a male research assistant, who would videotape the session to show to judges at a later time. The other half of the participants were told that they would try on the same revealing exercise apparel, in the same environment but alone. In general, participants in the body image SET conditions had higher levels of salivary cortisol compared to the control groups, demonstrating the applicability of the SSPT in a body image context. Martin Ginis et al. (2012) however did not examine the impact that body specific SET on shame, which is a key psychological response within SSPT.

Lamarche et al. (2014) conducted a similar experiment in which they told female university students that they were either going to wait quietly for 10 minutes or that they were going to have their body composition assessed using skinfold measures, while wearing revealing exercise apparel. They found increases in state body shame, dissatisfaction, and social physique anxiety, but not cortisol, in the experimental condition compared to the control condition when controlling for BMI. This finding was consistent with SSPT literature, such that anticipatory body image threats tend to evoke psychological, but not cortisol responses (Dickerson & Kemeny, 2004; Kelly, Matheson, Martinez, Merali, & Anisman, 2007). Alternatively, Lamarche et al. (2014) may have lacked the actual social-evaluative component needed for a biological response (Dickerson & Kemeny, 2004).

In order to determine the impact that the amount of anticipatory body image SETs have on psychobiological responses, Cloudt et al. (2014) conduct a study in university women in which participants were randomized into one of three groups. In the experimental conditions, participants were led to believe that they were going to have their body fat assessed and results read out loud while wearing revealing exercise clothing with either just the principal researcher present, or in a group of three to five researchers and three to five other participants. Those in the control condition were simply told that they were going to wait quietly for 15 minutes. Results revealed that those in both individual and group threat conditions had significantly higher salivary cortisol and state body shame compared to the no-threat condition, with no differences between the experimental conditions.

The aforementioned studies found increases state body shame and dissatisfaction, social physique anxiety, and salivary cortisol in response to body image SETs regardless of how many other people were present in the testing environment. These studies however found these psychobiological responses to anticipatory body image SETs, meaning that the actual social-evaluative stressor was simply described by the researcher to the participant (e.g., working out while wearing revealing clothing in a public space) but did not actually occur. Thus, it was unknown whether there would potentially be a stronger or unique pattern of psychobiological responses to the actual introduction of a body image SET compared to just the anticipation of one. Lamarche et al. (2016) were the first to examine psychobiological responses to actual body image SETs in healthy university women. Participants in the control condition were instructed to wait quietly for 15 minutes, while those in the experimental condition had their body fat assessed using skinfolds with results read out loud to a second researcher, while wearing a two-piece bathing suit. The researchers found significantly higher levels of state social physique anxiety and salivary cortisol in the experimental condition compared to the control condition. Additionally, there were significant correlations between social physique anxiety and salivary cortiso1 levels. While these studies support the application of SSPT to anticipatory and actual body image threats in women, body image concerns are not unique to university women.

Lamarche, Ozimok, Gammage, and Muir (2017) conducted a similar study in university men to examine body shame and cortisol responses to body image SET. Participants were randomly assigned to a high or low SET condition. Participants in the high-threat condition had several anthropometric measurements and a measure of overall strength taken while shirtless in front of two full-length mirrored walls. A male confederate, who met the North-American ideal for appearance for men, posed as a second participant and had his anthropometric and strength measurements taken and read out loud prior to the actual participants' measurements, while an attractive female confederate took the measurements. The men were also told that they would be videotaped while their measurements were being taking in order to review later for accuracy. Participants in the low-threat condition waited for 10 minutes before having the same anthropometric and strength measurements taken, in the absence of confederates and a video camera, away from mirrors, and while wearing a t-shirt. The results showed that participants in the high-threat group had higher levels of body shame and salivary cortisol compared to men in the low-threat condition, consistent with SSPT.

Smyth, Gammage, Lamarche, and Muir (2020) investigated body shame and cortisol responses to, and recovery from, a body image SET in men. They also examined the behavioural responses associated with social evaluation of the physique. Using the same experimental procedure as Lamarche et al. (2017), Smyth et al. (2020) found significantly higher body shame and cortisol responses in the high-threat condition compared to the low-threat condition immediately following the body image SET and 30-minutes post-stressors onset, respectively. Additionally, men in the high-threat group exhibited greater amounts of body shame and submissive behaviours (e.g., slumped posture, downward tilted head) compared to men in the low-threat condition. Lastly, Smyth et al. (2020) found no significant differences between groups for shame or cortisol 50-minutes post-stressor onset (i.e., recovery), indicating an adaptive and healthy recovery from the body image SET.

Though both men and women have shown psychobiological responses to social-evaluative body threat conditions, athlete status has yet to be examined within this context.

Athletes have been excluded from experiments involving body-specific SETs due to the unique relationship they have with their bodies. Researchers using non-body image SETs have suggested that athlete status may moderate psychobiological responses (Rimmele et al., 2007; Rimmele et al., 2009). Based on studies by Rimmele et al. (2007) and Rimmele et al. (2009), it is possible that athletes would have a blunted psychobiological response to body-specific SETs. However, additional social pressures for male athletes to uphold the muscular ideal due to their athletic involvement could lead to greater responses than non-athletes to body specific SETs. Nevertheless, athletes have yet to be examined in this context.

CHAPTER 2: RATIONALE, PURPOSE, AND HYPOTHESES

2.1 Rationale

While the majority of early body image research focused on young adult women, it is well-known that young adult men are also concerned about their bodies and experience body dissatisfaction and shame (Fiske et al., 2014). Exercise has been shown to reduce negative body image in men and women (Campbell & Hausenblas, 2009). In addition, athletes generally report less negative body image than exercisers or non-athletes, with higher level athletes reporting significantly lower levels of body image concerns compared to lower level athletes (Hausenblas & Symons Downs, 2001). Despite this finding, athletes still mention concerns over their physical appearance and note pressures from coaches, teammates, and peers about meeting and upholding the muscular ideal perpetuated in society (Galli & Reel, 2009; Lunde & Gattario, 2017). This may in part be due to the type of sport, as findings suggest that athletes in weight-dependent and appearance-focused sports have higher levels of disordered eating and negative body image, and lower levels of positive body image compared to those in non-appearance focused sports (Abbott & Barber, 2011; Chapman & Woodman, 2016; Varnes et al., 2013).

One theory that has been useful in understanding negative body image is SSPT, which holds that individuals have an innate need to belong and to be accepted by others (Dickerson & Kemeny, 2004; Dickerson et al., 2004; Kemeny et al., 2004). Social-evaluative threats are those that may pose a risk to one’s social identity (e.g., social standing, esteem, or status) by calling into question one’s abilities or competencies regarding certain characteristics, particularly those people regard as important to their social identity (Dickerson & Kemeny, 2004; Dickerson et al., 2004; Kemeny et al., 2004). Studies have shown that psychological (e.g., self-conscious emotional response; shame) as well as physiological (e.g., cortisol) reactivity occurs in response to psychosocial SETs as a warning that a person's social standing is at risk (Dickerson & Kemeny, 2004; Dickerson et al., 2004). However, sport participation has shown to buffer responses to psychosocial stressors as highly trained individuals tend to exhibit smaller psychobiological responses than amateur sportsmen and untrained individuals to SETs (Rimmele et al., 2007; Rimmele et al., 2009; Rohleder et al., 2007). However, athletes may respond differently to social-evaluation of the physique compared to other types of SET, given their differences in body image.

In non-athletes, research has shown psychobiological responses to body image SETs, in the form of increased body shame and dissatisfaction and cortisol, in recreationally active women (Cloudt et al., 2014; Lamarche et al., 2014; Lamarche et al., 2016; Martin Ginis et al., 2012) and men (Lamarche et al., 2017; Smyth et al., 2020), but research has excluded athletes due to different body image concerns (Hausenblas & Symons Downs, 2001). Whether psychobiological responses to body image SETs are lessened in athletes has yet to be investigated. Athletes may show blunted psychobiological responses to body image SETs due to their lower body image concerns compared to their non-athlete counterparts (Hausenblas & Symons Downs, 2001). Conversely, male athletes may face more pressure to uphold the muscular ideal perpetuated in society due to their athletic involvement (Galli & Reel, 2009; Lunde & Gattario, 2017) and thus exhibit similar or even greater psychobiological responses compared to their non-athlete counterparts.

2.2 Purpose

The purpose of the current study was to examine psychobiological responses (i.e., cortisol, body shame, and body dissatisfaction) to, and recovery from, a social-evaluative body image threat in university men who are non-athletes and varsity athletes from non-aesthetic sports.

2.3 Hypotheses

Due to the blunted psychobiological responses seen in previous studies that investigated non-appearance sport athletes (i.e., endurance runners) compared to non-athletes (Rimmele et al., 2007, Rimmele et al., 2009), it was hypothesized that there would be a three-way interaction between athletic status (athletes versus non-athletes), condition (high- versus low-threat), and time (pre-threat versus post-threat versus peak-threat versus recovery) for cortisol and state body shame and dissatisfaction, such that there would be significant increases in state body shame and state body dissatisfaction (pre to post-threat), and salivary cortisol (pre to intermediate-threat) in the high-threat condition only. These increases will be greatest amongst the non-athletes compared to the athletes. Furthermore, there will be no significant changes in state body shame, state body dissatisfaction, or salivary cortisol for either group of participants in the low-threat condition.

CHAPTER 3: METHODOLOGY

3.1 Participants

The current study focused on psychological and cortisol outcomes as part of a larger study that also examined inflammatory markers and testosterone responses. Participants consisted of 112 males between the ages of 17 and 28 who were either non-athletes (n = 63) or varsity/club athletes (n = 49). Participants were restricted based on age due to the importance typically placed on appearance during young adulthood (Tiggemann, 2011). Non-athletes were defined in this study as individuals who engaged in two or fewer bouts of physical activity per week, as they were less likely to meet recommended guidelines compared to those who engage in more frequent levels of physical activity (Piercy et al., 2018). Varsity athletes were not eligible to participate if they competed in aesthetic (i.e., the outcome of the competition is directly related to the competitors' physical appearance or body positioning/posture, such as cheerleading, figure skating, and gymnastics) or weight dependent sports (i.e., those in which athletes compete within weight classes or categories, such as powerlifting, rowing, boxing, and wrestling). These athletes were excluded because body image may differ in athletes from these types of sports compared to non-athletes (Chapman & Woodman, 2016; Galli & Reel, 2009; Varnes et al., 2013).

Chronic smokers, those with a history/diagnosis of a clinical eating disorder, and those previously diagnosed with a disease affecting cortisol, such as Cushing's or Addison's disease, or inflammatory markers, such as periodontal gum diseases, were not eligible to participate (Deinzer et al., 2004; Gold & Chrousos, 1985). Individuals were also excluded from the study if they were taking any anti-inflammatory medication, medication affecting cortisol, such as anti-depressants (Burke, Davis, Otte, & Mohra, 2005), or if they were using anabolic steroids. Eligible participants were emailed instructions 24 hours before their first session reminding them to refrain from engaging in physical activity, consuming any food or beverages, and brushing and flossing their teeth within one hour of the testing session so as not to influence the cortisol or inflammatory markers collected.

3.1.1 Participant Characteristics and Demographics

3.1.1.1 Ethnicity. The most frequently self-reported ethnicity of non-athletes was Caucasian (60.7%), followed by South Asian (9.8%), and Latino/Hispanic (8.2%). The remaining participants were a relatively evenly divided between other ethnicities (e.g. Asian, Native American, Middle Eastern, mixed). For the athletes, the most frequently reported ethnicity was also Caucasian (77.6%), followed by African American (10.2%). The remaining participants were relatively evenly divided between other ethnicities (e.g. Asian, Latino/Hispanic, South Asian, mixed).

3.1.1.2 Sexual orientation. Approximately 93% of non-athletes (n = 52) and 100% (n = 44) of the athletes' identified as heterosexual. For the non-athletes, 5.4% of the sample identified as bisexual (n = 3) and 1.8% of the sample identified as homosexual (n = 1).

3.1.1.3 Major and year of study. For the non-athletes, 52.5% of the sample (n = 32) were in their first-year, 24.6% were in their second year (n = 15), 11.5% were in their third year (n = 7), and 9.8% were in their fourth year (n = 6) of study. For the athletes, 30.6% percent of the sample were in their first year (n = 15), 28.6% were in their second year (n = 14), 32.7% were in their third year (n = 16), and 8.2% were in their fourth year of study (n = 4).

Most non-athletes came from two departments: 27% came from kinesiology (n = 17) and 27% from psychology (n = 17). The remaining 46 percent of the students were relatively evenly divided between the remaining departments (e.g., accounting, biology, business, computer science, dramatic arts, neuroscience). For athletes, 26.5% came from kinesiology (*n* = 13), 24.5% came from sports management (*n* = 12), 12.2% came from psychology (*n* = 6), and 10.2 percent came from business (*n* = 5).

3.1.1.4 Sports. The athletes in the study came from the following sports: 24.5% from volleyball (*n* = 12), 18.4% from rugby (*n* = 9), and 10.2% from lacrosse (*n* = 5). The remaining athletes came from a variety of other sports, such as basketball (*n* = 3), cross-country (*n* = 3), curling (*n* = 1), fencing (*n* = 2), track & field (*n* = 3).

3.1.1.5 Recruitment. Participants were recruited via (1) classroom and team announcements, (2) posters placed around Brock University, (3) emails to varsity coaches, (4) word of mouth, and (5) the SONA research website, which is an online website operated at the university through the psychology department for the recruitment of research participants. Prospective participants were recruited to take part in a study investigating the relationship between hormones, psychological characteristics, and physical measurements in athletes and low frequency exercisers. Participants were not told the true purpose of the study or about the social-evaluative manipulations prior to their completion of the study. Participants were sent the consent form and a copy of the recruitment poster, which listed the inclusion and exclusion criteria of the study, via email. After confirming that they met the inclusion criteria, participants were scheduled for their first visit.

3.1.1.6 Sample size. With a power of .80 and an α of .05, approximately 25 participants per group were required (i.e., 25 varsity/club athletes and 25 non-athletes in the high-threat condition, and 25 varsity/club athletes and 25 non-athletes in the low threat condition; Cohen, 1992). This number is based on medium to large effect sizes (body shame

$\eta_p^2 = .10$; body dissatisfaction $\eta_p^2 = .17$; cortisol $\eta_p^2 = .11$) observed in a previous study using similar methodology (Lamarche et al., 2017). This number accounted for dropout(s), problems with saliva sampling (e.g., not enough saliva for analysis), or issues meeting study requirements.

3.2 Study Design

This was a two-part study. The purpose of the first session was to (1) familiarize participants to the testing environment so that it did not act as a stressor during the second session; (2) familiarize participants with the saliva sampling procedure; and (3) obtain trait measures of various psychological characteristics (see **Measures** below). The second session was a mixed-experimental design with state body image questionnaires being completed at four timepoints (pre, post, intermediate, and recovery), and saliva samples being taken at five timepoints (baseline, pre, post, intermediate, recovery) throughout the session. Participants were randomly assigned to a high or low-threat condition without their knowledge prior to their first visit.

3.3 Measures

A copy of all questionnaires can be found in Appendix A.

3.3.1 Demographic questionnaire. The demographic questionnaire (1) screened participants before each visit in order to ensure they were eligible to partake in testing that day and (2) assisted in providing adequate time between the baseline and pre-threat saliva samples during the second session. In the first session, participants were screened for factors that could influence cortisol (e.g., antidepressant medication, hepatitis B). In the second session, participants self-reported age, major, year of study, ethnicity, sexual orientation, and varsity sport (if applicable). At both sessions, participants were screened for stressful events and prescription and non-prescription medications taken the day of testing, as well as if they followed the study requirements before arriving at the lab (i.e., refraining from eating, drinking, exercising, and brushing and flossing within one hour prior to the start of the session) and what time they woke up that day.

3.3.2 Sociocultural attitudes towards appearance questionnaire-4 (SATAQ-4; Schaefer et al., 2015). The SATAQ-4 (Schaefer et al., 2015) is a 22-item self-report questionnaire made up of five subscales. For the purpose of this study, only the subscale related to the internalization of the muscular/athletic ideal was used. Participants rated the 5-items on how much they agreed or disagreed with each of the statements ranging from 1 = *definitely disagree* to 5 = *definitely agree*. Mean scores were calculated and ranged from 1-5 with higher scores indicating higher levels of internalization of the muscular/athletic ideal. The muscular/athletic ideal subscale has shown adequate internal consistency ratings in US males (α = .90; Schaefer et al., 2015). In the current study, the muscular ideal subscale of the SATAQ-4 showed good internal consistency ratings for the low ($\alpha_{\text{Muscularity}}$ = .82) and high-threat conditions ($\alpha_{\text{Muscularity}}$ = .80), respectively.

3.3.3 International physical activity questionnaire-short (IPAQ-S; Craig et al., 2003). The IPAQ-S (Craig et al., 2003) assesses vigorous, moderate, and walking activity over the past 7-day period. Only total moderate and vigorous physical activity was analyzed in this study as they have been significantly related to positive physical and mental health outcomes in adults (World Health Organization, 2018) and is consistent with Canadian physical activity guidelines (Tremblay, 2011). Participants are asked to note the number of days per week, over the last 7-day period, that they engage in each intensity of physical activity for at least 10 minutes (World Health Organization, 2018). Next, they are asked to note the typical duration for one of those bouts of physical activity. To calculate moderate and vigorous MET minutes per week, the following formula was used: ([4.0METs x average moderate minutes per day x days per week of moderate physical activity] + [8.0 METs x average vigorous minutes per day x days per week of vigorous physical activity]).

3.3.4 Male body attitudes scale (MBAS; Tylka, Bergeron, & Schwartz, 2005). The MBAS (Tylka et al., 2005) is a 24-item self-report questionnaire with three subscales that measure attitudes about muscularity, low body fat, and height. Due to the importance placed on muscularity in men (Tiggemann, 2011), the current study only examined the muscularity subscale, making this a 10-item questionnaire. Participants rated the extent to which each statement applied to them on a 6-point scale, ranging from 1 = *never* to 6 = *always*. Means scores were calculated, with higher means scores indicating a greater desire for muscularity. The total MBAS, as well as the muscularity subscale has shown adequate internal consistency ratings ($\alpha_{\text{Muscularity}} = .89$ and $\alpha_{\text{Total}} = .91$; Tylka et al., 2005). In the current study, the muscularity subscale of the MBAS showed good internal consistency ratings for the low ($\alpha_{\text{Muscularity}} = .89$) and high-threat conditions ($\alpha_{\text{Muscularity}} = .89$), respectively.

3.3.5 Body image state scale (BISS; Cash et al., 2002). State body dissatisfaction was assessed through the BISS, which consists of 6-items rated on a scale ranging from 1 to 9 based on how the individual is feeling in that moment. A mean score was calculated with higher scores indicating higher levels of state body dissatisfaction. The BISS has shown an adequate internal consistency ($\alpha = .72$) and test-retest reliability in men ($r = .68$; Cash et al., 2002). In the current study, the BISS showed acceptable and good internal consistency ratings at each time point for the low ($\alpha_{\text{time 1}} = .78$; $\alpha_{\text{time 2}} = .80$; $\alpha_{\text{time 3}} = .81$; $\alpha_{\text{time 4}} = .85$)

and high-threat conditions ($\alpha_{time\ 1}$ = .79; $\alpha_{time\ 2}$ = .85; $\alpha_{time\ 3}$ = .87; $\alpha_{time\ 4}$ = .86), respectively.

3.3.6 Weight and body-related shame subscale (WBRSG-BS; Conradt et al., 2007). The WBRSG-BS consists of 6-items that are rated on a scale ranging from 0 = *strongly disagree* to 4 = *strongly agree* based on how the individual is feeling in that moment. Mean scores were calculated and ranged from 0-4 with higher scores indicating higher levels of state body shame. The original WBRSG-BS was a trait measure of body shame however, it has previously been adapted as a measure of state body shame and has shown adequate internal consistency in college women (α = .81 and .92; Cloudt et al., 2014) and men (α = .91 and .94; Lamarche et al., 2017). In the current study, the WBRSG-BS internal consistency ratings ranged from acceptable to excellent for the low ($\alpha_{time\ 1}$ = .81; $\alpha_{time\ 2}$ = .81; $\alpha_{time\ 3}$ = .82; $\alpha_{time\ 4}$ = .85) and high-threat conditions at each time point ($\alpha_{time\ 1}$ = .78; $\alpha_{time\ 2}$ = .89; $\alpha_{time\ 3}$ = .90; $\alpha_{time\ 4}$ = .89), respectively.

3.4 Manipulation Checks

3.4.1 Previous anthropometric experience. Participants were asked if they had any of the anthropometric or strength measurements taken previously. This measure was used to see if previously having undergone these measures could potentially explain any blunted psychobiological responses observed.

3.4.2 Perceptions of confederates. Participants in the high-threat condition were asked to rate how attractive they thought the female research confederate was and how similar the male confederate was to the muscular ideal. Participants rated the female confederate ranging from 0 = *Not at all attractive* to 4 = *Very attractive*. Participants rated the male confederate ranging from 0 = *Not at all my perceptions of the muscular ideal* to 4 = *my exact perceptions of the muscular ideal* (Lamarche et al., 2017; Smyth et al., 2020).

3.5 Saliva Collection Procedures

Saliva was collected using Salivettes. Participants were instructed to accumulate as much saliva in their mouth as possible. They were then be told to remove the cap off the plastic tube and place the swab in their mouth without using their hands, hold it in their mouth for one minute, and gently move saliva towards it without chewing, swallowing, or moving it around to avoid potential micro abrasions. After one minute, participants were told to guide the swab from their mouth back into the plastic tube without touching the edges of the container with their lips in order to avoid any potential contamination of saliva samples. Immediately after testing, the Salivettes were centrifuged at 3,400 rpm at 1,100 x g using the Hamilton Bell V6500 Vanguard and were stored in a freezer at -20°C (-4°F) until analyzed.

3.5.1 Salivary cortisol assay determinations. All enzyme immunoassays were carried out on NUNC Maxisorb plates. Cortisol antibodies (R4866) and matching horseradish peroxidase conjugate were obtained from C. Munro of the Clinical Endocrinology Laboratory, University of California, Davis. Steroid standards were taken from Steraloids, Inc. Newport, Rhode Island. Plates were initially coated with 50 µl of antibody stock diluted at 1:8500 in a coating buffer (50 mmol/L bicarbonate buffer pH 9.6). Plates were then sealed and stored for 12–14 hours at 4 °C. A 50 µl wash solution (0.15 mol/L NaCl solution containing 0.5 ml of Tween 20/L) was added to each well to rinse away any unbound antibody. Next, a 50 µl phosphate buffer was added to each well. After the buffer, plates were incubated at room temperature for two hours before standards, samples, or controls were added. Two quality control salivary samples, at 30% and 70% binding (the low and high ends of the sensitivity range of the standard curve), were prepared. A 50 µl cortisol horseradish peroxidase conjugate was added to each well, with a 50 µl of standard, sample, or control. Plates remained incubated for 1 hour after plate loading. Plates were then washed with 50µl wash solution and 100µl of a substrate solution of citrate buffer; H2O2 and 2,2′-azino-bis (3- ethylbenzthiazoline-6-sulfonic acid) was added to each well. The plates were next covered and incubated while shaking at room temperature for 30–60 min. Finally, plates were read with a single filter at 405 nm on the microplate reader (Titertek multiskan MCC/340). Blank absorbances was obtained, standard curves were generated, a regression line was fitted to the sensitive range of the standard curve (typically 40 – 60 % binding), and samples were interpolated into the equation to get a value in pg per well. Each sample was assayed in duplicate and averages were used.

3.6 Procedures

Ethics clearance was obtained before recruitment began (see Appendix B). All testing took place in Welch Hall 16 (WH16) at Brock University between the hours of 2pm and 7pm, when circulating cortisol is at its lowest and most stable for the day (Dickerson & Kemeny, 2004; Dunn, Scheving, & Millet, 1972) to ensure that any changes in cortisol were due to the experimental manipulations and not due to natural circadian rhythms. This room contains two fully mirrored walls as well as exercise equipment, which were removed from participants' field of vision during the testing procedures so as to not act as a stressor. All participants provided informed consent before testing commenced.

3.6.1 Session 1. For a visual representation of the timing and flow of the procedures in session one, see **Figure 1** below. Upon arrival to the lab, participants were screened verbally to ensure they followed the instructions prior to arriving at the lab with respect to eating, drinking and physical activity. Next, participants were seated at a desk, facing away from the mirrors in the room, provide informed consent, and were asked to provide the first saliva sample, to familiarize the participants with the procedure. Participants then completed demographic information, and physical activity and trait body image questionnaires, which were randomized. Upon completion of the questionnaires, the participants were given a reminder sheet with the date, time, and guidelines for saliva sampling for their second visit, which occurred at least 24 hours later. Lastly, participants were provided with either one-hour research participation credit or $10 cash.

Informed Consent
Saliva Sample (S1) (~3 minutes)
Trait Questionnaire Package: Demographic, SATAQ-4, IPAQ-S, MBAS (~30 minutes)

Figure 1. A Visual Representation of the Timing and Flow of the Procedures in Session 1
Each session will last approximately 45 minutes in length.

3.6.2 Session 2. Upon arriving to the lab, participants were screened verbally to ensure they followed the instructions prior to arrival and then underwent their respective condition as described below (see **Figure 2** for timing and flow).

3.6.3 High-threat condition. The principal student researcher (male), a research assistant (female) and two confederates were present: a male confederate (described as a second participant) who represented the male ideal (muscular build, well-defined abdominals, strong arms and a "V" shaped figure; Frederick et al., 2007; McFarland & Petrie, 2012; Pope et al., 1999; Thompson & Cafri, 2007) and a female confederate (described as a second research assistant) who represented the female ideal (thin and attractive according to North American standards; Algars et al., 2009; Grogan, 2017). Testing in the high threat condition took place in front of the two mirrored walls, to ensure that the participants were focused on their own and the confederate's physique throughout the testing procedure.

Participants were asked to change into their shorts using the private washrooms around the corner from the lab. Once they return, they were directed to their seat, which was situated immediately to the right of the male confederate, to force them to either look at the two mirrored walls located in front of them and to their right, or the male confederate during the entirety of the testing session.

A baseline saliva sample was taken followed by completion of demographic information. Then, participants completed the pre-threat state body image questionnaires and the pre-threat saliva sample. At this time, the female confederate and research assistant brought out the testing equipment (i.e., skin calipers and measuring tape, handgrip dynamometer, scale, and stadiometer) and set up the video camera. The principal student researcher then explained all testing procedures. Participants were told that they would undergo several anthropometric and strength assessments to indicate overall strength and muscularity with their shirts off for accuracy. They were told that the video camera was there to ensure the measurements were taken properly and accurately (although it was not actually recording). Standardized laboratory procedures for all anthropometric and strength measures were used (see **Anthropometric and Strength Measures**).

Screening & Baseline Saliva Sample (S2) (~3 minutes)

Demographic Questionnaire & State Body Image Questionnaires (T1) (~ 5 minutes)

Pre-Threat Saliva Sample (S3) (~3 minutes)

High Threat	**Low Threat**
Confederate's Anthropometric & Strength Measurements (~10 minutes)	Wait 10 minutes
Participant's Anthropometric & Strength Measurements (~10 minutes)	Participant's Anthropometric & Strength Measurements (~10 minutes)

Post-Threat Saliva Sample (S4) & State Body Image Questionnaires (T2) (~5 minutes)

Wait 10 minutes

Intermediate Saliva Sample (S5) & State Body Image Questionnaires (T3) (~5 minutes)

Wait 20 minutes

Recovery Saliva Sample (S6) & State Body Image Questionnaires (T4) (~5 minutes)

Manipulation Checks (~3 minutes)

Debriefing & Final Consent

Figure 2. A Visual Representation of the Timing and Flow of the Procedures in Session 2
Each session will be approximately 75 minutes in length.

The male confederate was always tested first directly in front of the participant. All measurements were taken and read out loud by the female confederate, such that everyone in the room could hear, and were recorded by the principal student researcher. Once all the measurements were completed, participants were told that the research assistant was going next door to calculate percent body fat and determine norms for the first participant's (male confederate's) values. Upon returning to the room (in approximately two to three minutes) the research assistant passed the "results" to the female confederate, who then read the confederate's "results" out loud so all could hear. Values indicated that the male confederate tested in the healthiest range for percent body fat and in the upper range for strength and arm, chest, and waist circumferences, similar to what is typically seen for international level athletes. Then, the participant underwent the same anthropometric measurements in the exact same order. The female confederate read all measurements outloud for everyone in the room to hear. However, upon completion, the participant was told that testing was running behind schedule and that in order to save time, testing would proceed, and all measurements would be made available to the participant, if he wished, at the end of the testing session.

Immediately following the anthropometric and strength measures, the post-threat saliva sample along with post-threat state body image questionnaires were completed. Following a 10-minute wait period, where the participants were asked not to talk, sleep, or use any electronics, participants provided another saliva sample and completed state body image questionnaires. This saliva sample was approximately 30-minutes post-stressor onset, which has been shown to be the peak cortisol response to psychological stressors (Dickerson & Kemeny, 2004). Following a 20-minute wait period, participants provided the final saliva sample and completed the final state body image questionnaire package. This saliva sample and questionnaire package were approximately 50-minutes post-stressor onset and served as a recovery time point (Dickerson & Kemeny, 2004). Lastly, participants completed the perceptions of confederates and previous anthropometric experience questionnaires.

3.6.4 Low-threat condition. Testing in the low-threat condition was performed in the same laboratory as the high-threat condition, however, all of the testing was performed away from the mirrored walls. Only the principal student researcher (male) and one other research assistant (female) were present in the low-threat condition. Once participants were screened, they were asked to change into their shorts and t-shirt. The anthropometric tests were the same as those in the high-threat condition but were recorded quietly without any feedback given to the participants and with no video camera present. The participants waited quietly for 10-minutes before completing their anthropometric measurements to account for the time of the confederate's measurements in the high-threat condition. Due to the removal of the social-evaluative aspects of the design (i.e., mirrors, confederates, additional researchers, video camera, and shirtless anthropometrics with feedback), the low-threat condition acted as the control groups for the athletes and non-athletes, respectively.

3.7 Anthropometric and Strength Measures

Specific measurements that were taken included arm, chest and waist circumference, percent body fat (using three-site skin fold measurements: chest, abdomen, and thigh), strength using the handgrip dynamometer, and height and weight, in that order. These measurements were chosen specifically due to the tendency of men to show preoccupations with their arm, chest, and abdomen size, their height and strength (Cafri & Thompson, 2004).

Measurements began with flexed biceps circumference, followed by chest circumference and waist circumference. These measurements were repeated three times each for accuracy. For biceps circumference, participants flexed their biceps while the measuring tape was placed around the peak of the biceps (the largest part) and recorded to the nearest centimeter. For the biceps circumference, measurements were taken for each arm, alternating arms each time. For chest circumference, the measuring tape was placed around the widest part of the chest and recorded to the nearest centimeter. For the waist circumference, the measuring tape was placed at the top of the iliac crest and recorded to the nearest centimeter (Ardern, Janssen, Ross, & Katzmarzyk, 2004; Klipstein-Grobisch, Georg, & Boeing, 1997; Taylor & Behnke, 1961).

Body fat percentage was estimated using the Jackson-Pollock three-site skinfold method (Jackson & Pollock, 1978). Measurement sites included the chest, abdomen, and thigh. The chest measurement was taken one-half to one-third of the distance between the nipple and armpit, closer to the armpit, using a diagonal fold from the armpit to the nipple. The abdomen measurement was taken 4-5 centimeters (roughly 2 inches) adjacent to the umbilicus (belly-button) using a vertical fold. The thigh measure was taken at the anterior midline of the thigh, midway between the proximal border of the patella (upper knee) and inguinal crease (hip) using a vertical fold (Bray et al., 1978). Measurement sites were first landmarked to ensure consistency between measurements using a non-permanent marker. Once the measurement sites were marked, the tester pinched the skin with the thumb and forefinger roughly half of an inch from the measurement site. The skin was then gently lifted allowing the adipose tissue to separate from the underlying muscle. The calipers were then applied to the lifted skin and adipose tissue, and the tester would wait for 4 seconds before reading the value. Each measurement was taken three times and an average score was calculated. Percent body fat was calculated using the Jackson-Pollock formula (Jackson & Pollock, 1978).

A handgrip dynamometer was used to assess participants' (handgrip) strength. Participants were asked to stand with the dynamometer in the testing hand, with their arm raised to shoulder height at the side of their body. Participants were then instructed to keep their arm straight and form a right angle (90 degrees) with their body at the shoulder joint. Participants were asked to take a deep breath, and then exhale and squeeze the dynamometer with maximum force. Participants were asked to slowly lower the dynamometer towards their leg (without contacting their leg). This procedure was repeated two times for each hand, alternating sides, and the highest score for each hand was summed to get their final score (Mathiowetz, Weber, Volland, & Kashman, 1984).

Height and weight were measured with shoes and socks removed. Participants were asked to stand tall with their feet flat and heels against the back of a stadiometer. They then took a deep breath and exhaled as the moveable arm was lowered until contact was made with the top of the participant's head. This value was recorded to the nearest millimeter (Lund, 1995). Weight was measured using a standard scale step and recorded to the nearest tenth of a kilogram.

3.8 Data Analysis

All data was analysed using IBM's SPSS statistics software version 25.0.

3.8.1 Data Screening & Assumptions

Missing data was screened to ensure that it was random in nature using Little's Missing Completely at Random (MCAR). Missing data were replaced with the series means stratified by athletic status for the state measures, the value from the previous timepoint (Field, 2013). Histograms, split by athlete status, were used to visually examine for potential univariate outliers. Following the identification of a potential outlier, z-scores were calculated and values beyond the ±3.29 were winsorized. Mahalanobis' distance for each participant was calculated for each of the dependent variables (i.e., body shame, dissatisfaction, and cortisol). Outliers were evaluated using the χ^2 distribution, with degrees of freedom equal to the number of variables for the psychological variables and cortisol (n = 4, n = 5, respectively, $p < .001$).

To assess for univariate normality, skewness and kurtosis values were calculated; skewness values beyond ±3 and kurtosis values beyond ±2 suggested a non-normal distribution (Field, 2013). Additionally, histograms were produced, to visually inspect the distribution to ensure a bell-shaped curve (Field, 2013).

Because the participants were recruited through various purposeful methods around the university, the assumption of independentrandom sampling was violated and a convenience sample was used instead. Participants were randomized to the high or low-threat condition, stratified by athletic status. Participant group size varied slightly but were still similar and thus the assumption of equal sample size among groups was upheld.

Homogeneity of covariance (sphericity) was assessed using Mauchly's test of sphericity for the RM ANCOVA. Where this assumption was violated, Greenhouse-Geisser values were analysed. Homogeneity of regression slopes, which is the assumption that the covariate is independent of the independent variables, was tested by producing multiple analysis of variances (ANOVAs) with potential covariates as the dependent variable and the body image variables or cortisol as the independent variable. In order to uphold this assumption, the covariate (dependent variable) needs to not be significantly related to the independent variables.

Correlations between dependent variables were examined to ensure that variables were not multicollinear (i.e., redundant). Absence of multicollinearity was assumed if all bivariate correlations fell below .90 (Field, 2013).

3.9 Manipulation Checks

3.9.1 Randomization and group equivalence. A series of independent sample t-tests were conducted to examine for potential differences between groups on demographic, pre-threat state body image measures, pre-threat cortisol levels, strength, internalization of the muscular ideal, trait body image, physical activity, total number of anthropometric and strength measurements, and body fat percentage.

3.9.2 Total previous anthropometric experience. The total number of previous anthropometric and strength measurements taken prior to testing was examined in order to determine if blunted responses were due to novelty of the experimental manipulation. Correlations were produced to examin the relationship between the total number of previous measurments and the dependent variables at each timepoint, split by athlete status and condition.

3.9.3 Perceptions of confederates. In the high-threat condition, means were calculated and visually inspected to examine whether or not the participants perceived the male and female confederates as meeting or approaching Western society's body ideals.

3.10 Hypothesis Testing

To test the hypothesis that there would be a significantly greater increase in state body shame and dissatisfaction and salivary cortisol for the non-athletes compared to the athletes in the high-threat condition, three 2 (low- vs. high-threat) x 2 (varsity athlete vs. non-athlete) x 4 (pre vs. post vs. intermediate vs. recovery timepoint) repeated measures analyses of variance (RM ANOVAs) were run. If covariates were identified through correlations, RM ANCOVAs were conducted. If three-way interactions were not significant, two-way interactions were analyzed. If no two-way interactions were found, main effects were analyzed.

CHAPTER 4: RESULTS

4.1 Data Screening and Assumptions

A total of 127 participants took part in the first session of the study. Of the 127 participants, nine participants (*n* = 4 and *n* = 5 from the low and high-threat conditions, respectively) did not return to complete the second session. Of the remaining 118 participants, six participants (*n* = 5 and *n* = 1 for the low and high-threat conditions, respectively) did not meet study eligibility requirements and as such were removed from the final analyses (i.e., participants engaged in high levels of physical activity). The final sample consists of 112 university males: 63 non-athletes and 49 athletes.

Seventeen data points were missing from the SATAQ-4 (*n* = 4) and MBAS (*n* = 13) combined. Missing values were determined to be random in nature for both the SATAQ-4 (χ^2 21.933, DF = 18, p = .235) and MBAS (χ^2 48.299, DF = 63, p = .914), and were replaced with the series mean split by athletic status. Two participants did not complete the first half of the BISS at time 2 though all other time points were completed. These missing values were replaced with the corresponding time 1 values. Twenty-four data points were missing from the salivary cortisol. Missing values were replaced with their previous timepoint value. Missing time 1 values were replaced with time 2 values.

Visual inspection of the histograms for self-reported physical activity identified two potential outliers. Z-scores were calculated, and one athlete and one non-athlete fell above the ±3.29 cut-off. These values were winsorized and histograms were generated again. Two non-athletes were next identified, and z-scores were calculated to show values above ±3.29. These values were winsorized, and histograms and z-scores were produced once more. Following, no outliers were identified.

Mahalanobis' distance for each participant was calculated for each of the dependent variables (i.e., body shame, dissatisfaction, and cortisol). Outliers were evaluated using the χ^2 distribution, with degrees of freedom equal to the number of variables for the psychological variables (n = 4; 18.57) and cortisol (n = 5; 20.52) at $p < .001$. No multivariate outliers were identified.

Skewness and kurtosis values for the athletes and non-athletes in the low and high-threat conditions were less than ±2 and ±3, respectively. Thus, the assumption of univariate normality was met (Field. 2013).

The assumption of independent random sampling was violated due to the purposeful sampling utilized and voluntary participation of the individuals.

Group sizes ranges from 21 to 34 participants. While group sizes varied, they were relatively close, and the analyses were robust to violations of this assumption (Field, 2013).

The RM ANCOVA for state body dissatisfaction and the RM ANOVA for state body shame violated the assumption of homogeneity of covariance. As such, Greenhouse-Geisser values were analyzed for these analyses. The RM ANCOVA for salivary cortisol upheld this assumption.

Analyses revealed no significant athlete status by condition interaction for MBAS – Muscularity scores ($F_{1,108} = 1.06$, $p = .305$), as well as no main effects of athlete status ($F_{1,108} = .64$, $p = .426$) or condition ($F_{1,108} = 1.23$, $p = .270$). For baseline salivary cortisol, there was also no significant interaction ($F_{1,108} = 3.94$, $p = .05$) or main effect of athlete status ($F_{1,108} = 1.35$, $p = .248$) or condition ($F_{1,108} = .48$, $p = .488$). Thus, the assumption of independence of covariance and treatment effect was upheld.

Group scatterplits were produced and visually inspected in order to examin the relationship between the covariate(s) and the dependent variables at each level of the independent variables. All relationships appeared linear and thus the assumption was upheld.

Correlations between the dependent variables were all below .90 and thus the assumption of multicollinearity was upheld (Field, 2013).

4.2 Manipulation Checks

4.2.1 Randomization and group equivalence. Athletes and non-athletes differed significantly on height ($F_{1,108} = 5$, $p < .001$), weight ($F_{1,108} = 4.48$, $p = .037$), physical activity ($F_{1,108} = 26.03$, $p < .001$), and internalization of the muscular ideal ($F_{1,108} = 14.81$, $p < .001$) with athletes being significantly higher on each measure. Athletes in the high-threat condition had significantly greater levels of strength compared to the athletes in the low-threat condition and the non-athletes in the low and high-threat condition ($F_{1,108} = 4.09$, $p = .046$). There were no significant differences for the non-athletes in the low and high-threat condition on height, weight, body fat percentage, strength, physical activity, internalization of the muscular ideal, or male body attitude scores. For the athletes, there was a slight difference in overall strength, with those in the high-threat condition exhibiting significantly greater levels, however all other measures were not significantly different.

4.2.2 Total previous anthropometric experience. Correlations were produced to examine the relationship between the total number of previous measurments and the dependent variables at each timepoint, split by athlete status and condition. Athletes (M = 3.32, SD = 1.95; M = 1.71, SD = 1.65) and non-athletes (M = 1.59, SD = 1.56; M = 1.72, SD = 2.19) in the low and high-threat condition differed slightly, with athletes in the low-threat condition having a higher total number compared to athletes in the low-threat condition and non-athletes in either condition ($F[1,108] = 6.02$, $p = .014$). Total previous anthropometric and strength measurements were not significantly correlated to any of the dependent variables at any timepoint (all $p > .05$). Thus, it was determined that this difference did not significantly impact the results of the study.

4.2.3 Perceptions of confederates. Athletes ($M = 3.05$, $SD = .92$; $M = 3.19$, $SD = .60$) and non-athletes ($M = 3.04$, $SD = .85$; $M = 3.14$, $SD = 1.09$) in the high-threat group did not differ in their perceptions of the female ($t[46] = -.041$, $p = .967$) and male ($t[45.24] = -.217$, $p = .829$) confederates, respectively. Moreover, both means were well over the half-way point of two. Thus, it was assumed that the confederates met/approached Western society's body ideals and served their role.

4.3 Descriptive Statistics and Correlations

Means and standard deviations were calculated for age, height, weight, strength, body fat percentage, physical activity, and trait body image measures, split by athlete status and condition (Table 1). As previously mentioned, athletes had significantly greater height, weight, physical activity and internalization of the muscular ideal.

Table 1

Descriptive Statistics by Condition and Athlete Status

Demographic variables	Non-Athlete Low-Threat (*n* = 34) M (SD)	Non-Athlete High-Threat (*n* = 29) M (SD)	Athlete Low-Threat (n = 28) M (SD)	Athlete High-Threat (n = 21) M (SD)
Age	19.76 (2.56)	19.55 (2.06)	19.79 (1.32)	19.76 (1.26)
Height (cm)	176.96 (6.64)	176.69 (7.18)	182.47 (9.18)	182.73 (8.32)
Weight (kg)	74.68 (15.65)	77.4 (13.26)	79.53 (14.74)	84.31 (13.77)
Body Fat Percentage	14.43 (7.93)	16.62 (8.83)	12.33 (7.1)	12.96 (8.64)
Strength	77.24 (22.47)	82.55 (18.08)	84.25 (15.81)	104.43 (18.87)
Physical Activity	1388.62 (1492.04)	1155.24 (1463.13)	2686.43 (1576.81)	3001.57 (1975.93)
MBAS - Muscularity	3.47 (1.06)	3.45 (1.05)	3.51 (1.06)	3.10 (.84)
SATAQ - Muscularity	3.17 (.91)	3.78 (.79)	3.22 (.95)	3.92 (88)

Note. Physical activity is reported in MET minutes per week. MBAS – muscularity = concerns about muscularity (range: 1–6); SATAQ – muscularity = internalization of the muscular ideal (range: 1–5).

Means and standard deviations for the dependent variables at each time point, by condition and athletic status, were calculated (Table 2).

Table 2

Descriptive Statistics for State Body Dissatisfaction, Shame and Salivary Cortisol by Athlete Status and Condition at Each Timepoint

	Non-Athletes		Athletes	
Dependent variables	Low-Threat (n = 34) M (SD)	High-Threat (n = 29) M (SD)	Low-Threat (n = 28) M (SD)	High-Threat (n = 21) M (SD)
Pre-cortisol	4.61 (3.85)	2.37 (1.76)	3.87 (3)	3.21 (3.11)
Post-cortisol	5.03 (3.85)	2.36 (2.14)	4.41 (3.91)	2.57 (2.16)
Intermediate-cortisol	4.75 (3.67)	3.32 (2.42)	4.02 (3.19)	3.67 (2.6)
Recovery-cortisol	4.16 (3.44)	3.56 (2.06)	4.07 (3.42)	3.33 (1.68)
Pre-BISS	4.5 (1.19)	4.27 (1.13)	4.16 (.98)	3.5 (1.05)
Post-BISS	4.69 (.97)	4.77 (1.4)	4.24 (1.18)	3.95 (1.08)
Intermediate-BISS	4.69 (.92)	4.72 (1.33)	4.21 (1.2)	3.75 (1.17)
Recovery-BISS	4.55 (1.02)	4.55 (1.19)	4.2 (1.12)	3.64 (1.14)
Pre-WBRSG	.82 (.54)	.64 (.57)	.52 (.59)	.32 (.36)
Post-WBRSG	.74 (.59)	.81 (.75)	.53 (.61)	.53 (.65)
Intermediate-WBRSG	.67 (.57)	.68 (.75)	.42 (.5)	.35 (.47)
Recovery-WBRSG	.59 (.59)	.61 (.73)	.42 (.53)	.32 (.41)

Note. Cortisol = salivary cortisol; BISS = state body dissatisfaction (range: 1–9); WBRSG = state body shame (range: 0–4).

4.3.1 Correlations. Pearson's correlations were calculated for the height, weight, physical activity, strength, MBAS – muscularity, SATAQ – muscularity, and baseline cortisol with each of the dependent variables in order to identify potential covariates. For cortisol and state body dissatisfaction, baseline salivary cortisol and attitudes towards muscularity (MBAS), respectively, were identified as covariates and added into their respective analyses. No covariates were identified for state body shame.

4.4 Hypothesis Testing

4.4.1 State body dissatisfaction. A three-way mixed RM ANCOVA was produced, with the MBAS – muscularity subscale as a covariate. There was no significant three-way interaction between athlete status, condition, and time ($F_{2.08,222.87}$ = .19, p = .835, η^2 = .002). There was no significant interaction between athlete status and condition ($F_{1,107}$ = .065, p = .422, η^2 = .006), however, there was a main effect of athlete status ($F_{1,107}$ = 8.848, p = .004, η^2 = .076) with athletes having lower levels of body dissatisfaction overall compared to non-athletes, regardless of condition. There was also a significant time by condition interaction ($F_{2.08,222.87}$ = 3.21, p = .04, η^2 = .029). Since there was no significant three- or two-way interactions with athlete status, participants were combined, and follow-up RM ANCOVAs were produced to examine changes over time in each condition. Means and standard deviations for the dependent variables at each time point, by condition, were calculated (Table 3).

In the low-threat condition, the follow-up analyses revealed no significant changes in state body dissatisfaction over time ($F_{1.9,114.17}$ = .998, p = .368, η^2 = .016). In the high-threat condition, there was also no significant main effect of time ($F_{2.2,105.8}$ = .348, p = .727, η^2 = .007). Thus, follow-up pairwise comparisons were not conducted.

Table 3

State Body Dissatisfaction and Shame, and Salivary Cortisol by Condition, at Each Timepoint

Dependent variables	Low-Threat (n = 62) M (SD)	High-Threat (n = 50) M (SD)
Pre-cortisol	4.27 (3.48)	2.73 (2.42)
Post-cortisol	4.75 (3.86)	2.45 (2.13)
Intermediate-cortisol	4.42 (3.45)	3.47 (2.48)
Recovery-cortisol	4.12 (3.4)	3.46 (1.89)
Pre-BISS	4.35 (1.1)	3.95 (1.15)
Post-BISS	4.49 (1.09)	4.43 (1.33)
Intermediate-BISS	4.47 (1.07)	4.31 (1.34)
Recovery-BISS	4.4 (1.07)	4.17 (1.24)
Pre-WBRSG	.69 (.58)	.51 (.51)
Post-WBRSG	.65 (.6)	.69 (.72)
Intermediate-WBRSG	.56 (.55)	.54 (.66)
Recovery-WBRSG	.51 (.57)	.49 (.62)

Note. Cortisol = salivary cortisol; BISS = state body dissatisfaction (range: 1–9); WBRSG = state body shame (range: 0–4).

4.4.2 State body shame. A three-way mixed RM ANOVA was produced. There was no significant three-way interaction between athlete status, condition, and time ($F_{2.43,262.57}$ = .148, p = .899, η^2 = .001). There was no significant interaction between athlete status and condition ($F_{1,108}$ = .115, p = .736, η^2 = .001), however, there was a main effect of athlete status ($F_{1,108}$ = 6.421, p = .013, η^2 = .056) with athletes reporting lower levels of body shame overall compared to the non-athletes, regardless of condition. There was also a significant time by condition interaction ($F_{2.43,262.57}$ = 4.58, p = .007, η^2 = .041). Since there was no significant three- or two-way interactions with athlete status, participants were combined, and follow-up RM ANOVAs were produced to examine changes over time within in each condition. In the low-threat condition, the RM ANOVA revealed a significant main effect of time ($F_{2.56,156.13} = 8.98$, $p < .001$, $\eta^2 = .128$), and follow-up pairwise comparisons showed significant decreases in state body shame from the pre-threat to intermediate and recovery time points ($p = .013$; $p = .001$, respectively), and from post-threat to intermediate and recovery time points ($p = .018$; $p = .004$, respectively). When examining the high-threat condition, there was a significant main effect of time ($F_{2.2,107.54} = 6.56$, $p = .001$, $\eta^2 = .118$). Follow-up pairwise comparisons revealed significant increases in state body shame from pre to post-threat ($p = .05$). Follow-ups also revealed significant decreases from post-threat to the intermediate and recovery timepoints ($p = .022$; $p = .003$, respectively).

4.4.3 Salivary cortisol. A three-way mixed RM ANCOVA was produced, with baseline salivary cortisol as the covariate. There was no significant three-way interaction between athlete status, condition, and time ($F_{3,321} = .356$, $p = .785$, $\eta^2 = .003$). There was also no significant interaction between athlete status and condition ($F_{1,107} = .073$, $p = .787$, $\eta^2 = .001$) or main effect of athlete status ($F_{1,107} = .392$, $p = .532$, $\eta^2 = .004$). However, there was a significant time by condition interaction ($F_{3,321} = 3.34$, $p = .02$, $\eta^2 = .03$). With no significant difference between the athletes and non-athletes, participants were combined, and follow-up RM ANCOVAs were produced to examine changes over time by condition. In the low-threat condition, the follow-up RM ANCOVA revealed a significant main effect of time ($F_{3,180} = 2.766$, $p = .043$, $\eta^2 = .044$); however, the follow-up pairwise comparisons were not significant. In the high-threat condition, the RM ANCOVA was significant ($F_{3,144} = 5.83$, $p = .001$, $\eta^2 = .108$) and follow-up pairwise comparisons revealed significant increases in salivary cortisol from post-threat to the intermediate timepoint (p = .011), and significant increases from post-threat to the recovery timepoint (p = .016).

Chapter 5: Discussion

The overall purpose of the current study was to examine psychobiological responses (i.e., cortisol, body shame, and body dissatisfaction) to, and recovery from, a social-evaluative body image threat in university men who were non-athletes and varsity athletes from non-aesthetic sports. It was first hypothesized there would be significant increases in salivary cortisol (pre- to intermediate-timepoint) and state body shame and dissatisfaction (pre- to post-threat) in the high-threat condition only, with a subsequent return to baseline values 50-minutes post-stressor onset. Further, it was hypothesized that these increases would be greatest amongst the non-athletes compared to the athletes in the high SET condition. Last, it was hypothesized that there would be no significant changes in non-athletes and athletes' psychobiological responses in the low SET condition. These hypotheses were partially supported such that participants in the high-threat condition only exhibited significant increases in state body shame and salivary cortisol with a subsequent return to baseline values; however, there were no significant differences between the non-athletes and athletes' responses. Moreover, while state body shame showed a significant increase from pre-to post-threat, body dissatisfaction did not change over time. Lastly, contrary to the hypotheses, there was a significant decrease in state body shame in the low SET condition.

5.1 Athletes vs. Non-Athletes

The present study examined psychobiological responses to body-specific SETs between university athletes from non-aesthetic sports and non-athletes. Contrary to both body image (Hausenblas & Symons Downs, 2001; Varnes et al., 2013) and SSPT (Rimmele et al., 2007; Rimmele et al., 2009) research, athletes and non-athletes did not differ significantly in terms of their body shame and salivary cortisol responses to the body specific SET.

5.1.1 Body image. Studies have shown that athletes tend to exhibit less body dissatisfaction compared to non-athletes and exercisers and the current study does so as well, finding that athletes had lower overall levels of body dissatisfaction and shame compared to non-athletes (Hausenblas & Symons Downs, 2001). A previous study by Hausenblas and Symons Downs (2001) found that athletes competing at higher levels of competition experienced significantly lower levels body dissatisfaction compared to athletes competing at lower levels of competition and non-athletes. SSPT research has supported the idea that athletes exhibit lower psychological responses to psychosocial stressors compared to non-athletes. Rimmele et al. (2007) and Rimmele et al. (2009) found that untrained men had significantly worsened mood and calmness, and greater anxiety, compared to elite athletes following a psychosocial stressor (i.e., TSST). While the current study was the first study to examine shame responses in athletes, it was expected that both state body dissatisfaction and shame would follow a similar pattern as other psychological responses (i.e., calmness, mood, and anxiety) with athletes exhibiting smaller changes in state body dissatisfaction and shame following a social-evaluative body image threat compared to non-athletes. There are, however, some potential reasons as to why athletes in the current study exhibited similar psychological responses compared to the non-athletes.

First, while previous studies have examined athletes' psychological responses in the form of anxiety, calmness, mood, and perceived stress, this is the first study to examine shame responses in athletes versus non-athletes (Rimmele et al., 2007; Rimmele et al., 2009; Rohleder et al., 2007). It is possible that athletes are trained to manage commonly occurring emotions, such as anger, anxiety, and calmness, in high stress situations compared to more complex emotions (i.e., self-conscious emotions), such as shame (Martinent, Ledos, Ferrand, Campo, & Nicolas, 2015). Research has shown that emotions serve specific goals and purposes. Basic emotions serve survival and reproductive goals and self-conscious emotions serve social goals, such as avoiding social exclusion and protecting from social-evaluation (Tracey & Robins, 2004). In order to feel shame, individuals have to internalize a societal standard and reflect on the discrepancy present between the self and societal ideals (Tracey & Robins, 2004). Shame is elicited in response to this discrepancy and social-evaluation in order to bring attention to the discrepancy such that action can be taken to mitigate it. Thus, while other studies demonstrated significant differences between athletes and non-athletes, they examined other types of complex emotions (e.g., anxiety, calmness, mood) but failed to investigate self-conscious emotions, which specifically serve to protect against social evaluation and threats to the social self (Dickerson & Kemeny, 2004; Dickerson et al., 2004; Kemeny et al., 2004; Rimmele et al., 2007; Rimmele et al., 2009; Tracey & Robins, 2004). Shame had previously never been examined in the context of athletic status and it is possible that shame significantly increases across all participants and studies regardless of athlete status or competition level due to the social-evaluative nature of the psychosocial stressors (i.e., TSST and body image SETs).

Also, the varsity athletes in the current study were at an amateur level and potentially showed greater psychological responses compared to previous studies that examined more elite level athletes. Rimmele et al. (2007) and Rimmele et al. (2009) examined nationally competing endurance athletes and compared them with men who reported training less than 2 hours per week. These athletes were separated into elite and amateur levels based on training hours per week (16 hours vs. 8 hours), anaerobic threshold, and sprinting velocity. When separated, Rimmele et al. (2009) found significantly higher levels of state anxiety between the elite athletes and non-athletes but no significant differences in state anxiety between the amateur athletes and non-athletes. Similar results existed for salivary cortisol as well. It could be argued that most university varsity athletes are more accurately categorized as amateur level athletes as opposed to elite level athletes (Swann, Moran, & Piggott, 2015), with few exceptions, due to the frequency with which they compete at a national and international level, years of experience within the sport, and training frequency. Thus, it is possible that athletes in the current study showed body shame and salivary cortisol responses similar to amateur level athletes and non-athletes in previous studies (Rimmele et al., 2009).

Lastly, the non-athletes in the current study reported high levels of physical activity and met recommended weekly physical activity guidelines for adults (World Health Organization, 2018). As such, the non-athletes in the current study may have also had blunted psychological responses, similar to those of the amateur varsity athletes. Therefore, it is possible that differences between athletes and non-athletes were not found due to a very active control group and an athletic population competing at a lower level of competition compared to previous studies (Rimmele et al., 2007; Rimmele et al., 2009). These studies together help to highlight the complicated relationship that exists between athletes and their body image and supports the existing evidence suggesting that athletes experience body image concerns and respond to social evaluation of the physique (Galli & Reel, 2009; Lunde & Gattario, 2017).

5.1.2 Salivary cortisol. SSPT holds that social-evaluation and threats to the social-self lead to physiological responses in the form of increased cortisol (Kemeny et al. 2004). Few studies have examined athletes' physiological responses to social-evaluative threats, but those that have have shown somewhat inconsistent findings. Rohleder et al. (2007) found that ballroom dancers and non-athlete university students had similar salivary cortisol responses to the TSST. They also found that the dancers experienced significantly greater levels of salivary cortisol during the dance competition compared to the TSST. They concluded that real life stressors were more salient and challenged the social-self more than laboratory stressors, such as the TSST, resulting in significantly greater levels of salivary cortisol. By contrast, studies by Rimmele et al. (2007) and Rimmele et al. (2009) found that elite level athletes exhibited blunted cortisol responses to SETs compared to non-exercisers (Rimmele et al., 2007; Rimmele et al., 2009). As previously mentioned, elite and amateur level athletes were separated based on weekly training times and two measures of cardiorespiratory fitness. Athletes in the current study may have more closely resembled the amateur athletes examined by Rimmele et al. (2009); in their study, no significant differences in salivary cortisol between amateur athletes and non-exercisers were reported. Rimmele et al. (2009) suggested that this might be due to the frequency of stressors experienced (e.g., competition) but other studies have found no significant differences in salivary cortisol as a result of total number of previous competitions (Rohleder et al., 2007). It was also suggested that physiological changes and adaptations to psychosocial stressors may only occur as a result of prolonged high levels of physical activity rather than more graded levels, such as those seen in amateur athletics (Rimmele et al., 2009).

Together, these findings suggest that athlete versus non-athlete differences in responses to social-evaluative threats may depend on the type and level of athletes as well as the type of threat. Previous studies examined dancers (Rohleder e al., 2007) and endurance athletes (Rimmele et al., 2007; Rimmele et al., 2009) and findings may not be generalizable to other types of athletes or other types of psychosocial stressors. Studies have shown that athletes are not immune to body image concerns (Galli & Reel, 2009; Lunde & Gattario, 2017; Varnes et al., 2013) and suggest that unique relationships exist between athletes and their bodies. Therefore, it is possible that physical appearance and muscularity comprise a larger, more important part of the social self for athlete than non-athletes, which can result in greater physiological responses to body image SETs from athletes compared to public speaking tasks. This greater level of importance could eliminate the blunted response seen in previous studies, which were limited in the type of SET used (Rimmele et al., 2007; Rimmele et al., 2009).

5.2 Body Dissatisfaction and Shame

In the present study, state body shame significantly increased in the high-threat condition only, from the pre- to post-threat, while state body dissatisfaction did not significantly change over time. Further, state body shame returned to baseline by the recovery time point regardless of athlete status, indicating an adaptive emotional response to body image SETs in both athletes and non-athletes. These findings were partially consistent with the hypotheses of the study but remained consistent with the SSPT literature, which states that shame is a unique emotional response associated with social-evaluation (Dickerson & Kemeny, 2004; Dickerson et al., 2004).

One reason state body shame, but not dissatisfaction, increased immediately following the threat could be explained by examining the timing of the male confederate's introduction to the experiment and the social-evaluation of the participant's physique. All state body shame and dissatisfaction questionnaires were completed by the participants in the high-threat condition while in the presence of the male confederate. It is possible that participants judged and compared their physique to his and felt dissatisfied from the start of the study (Marquez & McAuley, 2001) but only experienced significant increases in state body shame when their body was exposed and while social-evaluation occurred during their measurements. Shame is a negative self-conscious emotion that is a key emotional response experienced when social-evaluation and threats to the social-self occur. Shame is elicited when there is a self-perceived transgression of some social standard (e.g., physique) which results in a global sense of failure (Keltner, 1996; Lewis, 2008; Sabiston et al., 2010). Thus, it is possible that participants felt dissatisfied with their physique while in the presence of the male confederate but felt a sense of failure, resulting in feelings of shame, only when their physique was being judged and deemed inferior compared to the confederates. This could result in consistent body dissatisfaction scores across all time points but significant increases in state body shame when social-evaluation of the physique was introduced and a subsequent return to baseline shame levels following the SET. Also contrary to the hypotheses, state body shame significantly decreased in the low-threat condition from the pre-threat to intermediate and recovery time points, and from post-threat to intermediate and recovery time points. It may be likely that participants in the low-threat condition gradually became more comfortable, resulting in decreased levels of state body shame over time.

Regardless, state body shame levels are consistent and similar in magnitude to Lamarche et al. (2017) and Smyth et al. (2020), who utilized the same experimental protocol to examine body shame responses to body image SETs in university men. In addition to state body shame increases, Smyth et al. (2020) also found significantly greater shame-related behaviours for men in the high-threat condition compared to the low-threat condition. These findings are also consistent with previous research involving anticipatory and actual body image SETs in women (Cloudt et al., 2014; Lamarche et al., 2014; Lamarche et al., 2016). Together, these studies demonstrate the ability that anticipatory and actual body image SETs have to lead to increased feelings of body-related shame and add to the SSPT literature by providing support for the use of body-specific SETs when investigating psychological responses (i.e., body shame) to social-evaluation in university women (Cloudt et al., 2014), men (Lamarche et al., 2017; Smyth et al., 2020), and male athletes.

5.3 Salivary Cortisol

The current study found significant increases in salivary cortisol from the post- to intermediate-threat time points. These findings are consistent with SSPT and previous studies investigating cortisol responses to actual body image SETs in men, which have found peak salivary cortisol responses occurring between 21-41 minutes post-stressor onset (Dickerson & Kemeny, 2004; Lamarche et al., 2017; Smyth et al., 2020). Though it was hypothesized that salivary cortisol would significantly increase from pre to intermediate-threat time points in the high-threat condition only, significant increases were found from post- to intermediate-threat time points. These findings were most likely due to the post-threat sample occurring too soon after the stressor onset to capture a peak cortisol response, while the intermediate time point which occurred approximately 30 minutes after the onset of the threat consistent with the peak cortisol responses to social-evaluative threats (Dickerson & Kemeny, 2004). Regardless, the current study is consistent with previous literature which found significant increases in salivary cortisol following social-evaluation of the physique in men (Lamarche et al, 2017; Smyth et al., 2020). However, contrary to previous SSPT and body image research (Smyth et al., 2020), the current study did not find any significant differences between the intermediate and recovery time points. Smyth et al (2020) found significant increases in salivary cortisol from pre to intermediate-threat time points, with a subsequent return to baseline values 50-minutes post stressor onset, indicating an adaptive physiological response to the body image SET (i.e., quick return to pre-threat levels). The current study, however, provides evidence to suggest that body image SETs may have lingering physiological effects. These effects could lead to prolonged cortisol secretion and chronically high levels should body image SETs occur frequently with a small timeframe. Overall, explanations for differences between Smyth et al (2020) and the current study regarding the physiological recovery of men to body image SETs is unknown and future research should continue to investigate the physiological effects of, and recovery from, social evaluation of the physique. Previous studies utilizing anticipatory body image SETs in women were inconsistent in their ability to cause a significant salivary cortisol response (e.g., Cloudt et al., 2014; Lamarche et al., 2014; Martin Ginis et al., 2012), however, other studies using actual body image SETs were able to consistently find increases in salivary cortisol in response to body image SETs (Lamarche et al., 2016; Lamarche et al, 2017; Smyth et al., 2020). Together, these studies suggest that actual, rather than anticipatory, body image SETs result in consistent increases in salivary cortisol.

In men, Lamarche et al. (2017) and Smyth et al. (2020) examined psychobiological responses to body-specific SETs and found significantly higher levels of salivary cortisol 30-minutes post-stressor onset in the high SET conditions compared to the control conditions. The current study utilized the same experimental protocol and measures as Lamarche et al. (2017) and Smyth et al. (2020) such that direct comparisons could be made between studies. Findings are consistent with Lamarche et al. (2017) and Smyth et al. (2020) and salivary cortisol levels in the current study are also similar in magnitude to those found by Lamarche et al. (2017) and Smyth et al. (2020), and studies involving women (Lamarche et al., 2016). Together, these studies expand SSPT and show that actual body image SETs can cause physiological responses in university women (Lamarche et al., 2016), men (Lamarche et al., 2017; Smyth et al., 2020) and male athletes.

5.4 Extension of Current Literature

5.4.1 SSPT. Presently, SSPT research has primarily focused on psychobiological responses to public speaking tasks, such as the TSST, with few studies examining the effect of different types of stressors. Investigation of athletes' psychobiological responses to SETs has also been scarce. Studies involving athletes have shown inconsistent psychobiological responses to SETs compared to non-athletes. For example, Rohleder et al. (2007) found no significant differences between athletes' and non-athletes' salivary cortisol responses to SETs, while Rimmele et al. (2009) found significant differences between elite athletes and non-exercisers with elite level athletes exhibiting blunted salivary cortisol responses to social-evaluation. However, Rimmele et al. (2009) also found no significant differences in salivary cortisol responses to SETs between the amateur level athletes and non-exercisers. They also found inconsistent findings as they pertain to psychological changes in response to psychosocial stressors (Rimmele et al., 2009). Specifically, while Rimmele et al. (2007) found significantly greater increases in state anxiety and decreases in state mood for non-exercisers compared to athletes, Rimmele et al. (2009) found significant increases in state anxiety between elite athletes and non-exercisers, but not between the amateur athletes and non-exercisers. These studies however are limited in the types and levels of athletes involved, the psychological responses measured, and the type of stressors utilized. For example, none of the studies investigating athletes' psychobiological responses examined changes in shame, which is key component of SSPT and the key emotional response to social-evaluation. Additionally, these studies examined athletes from a limited range of sports (i.e., dancers and endurance-sport athletes only; Rimmele et al., 2007; Rimmele et al., 2009; Rohleder et al, 2007). Finally, these studies have examined psychobiological responses to a limited number of other types of SETs (e.g., TSST, cognitive tasks, dance competition) and have yet to examine psychobiological responses to different types of psychosocial stressors that involve social-evaluation. Studies that utilize body image SETs, in which participants' physique or physical function in social settings is evaluated, have shown consistent increases in shame and cortisol responses in women (Lamarche et al., 2016) and men (Lamarche et al., 2017; Smyth et al., 2020) but have failed to examine athletes due to the unique body image concerns that exist in this population. The current study builds upon previous SSPT literature by examining shame and cortisol responses to a body image SET in a more diverse group of athletes and shows similar body shame and salivary cortisol increases in response to body image SETs between athletes and non-athletes.

5.4.2 Body image. The current study adds to the field of body image by helping to increase our understanding of the complex relationship that exists between athletes and their bodies. Generally, studies suggest that athletes competing in higher levels of competition experience lower levels of body dissatisfaction compared to athletes competing in lower levels of competition, and non-athletes, regardless of sports type (Hausenblas & Symons Downs, 2001). Moreover, Chapman and Woodman (2016) found that disordered eating patterns were equal amongst athletes and non-athletes, regardless of sport type. Varnes et al. (2013) however, demonstrated that body image concerns can differ when considering sport type and specific aspects of body image, such as body exposure and appearance/physique focus. In this review, Varnes et al. (2013) found higher body dissatisfaction, self-objectification, and body shame, and lower body esteem amongst athletes in appearance-focused sports compared to non-appearance focused sports. Other studies have also shown that athletes are not immune to body image concerns, and that athletes may experience specific and unique relationships with their bodies compared to non-athletes (Galli & Reel, 2009; Lunde & Gattario, 2017). The current study helps to expand the field of body image by demonstrating that male varsity athletes from non-aesthetic sports experience similar muscularity concerns and greater internalization of the muscular ideal compared to their non-athlete counterparts. Additionally, it builds upon body image literature that examines physiological responses to, and recovery from, body image stressors in varsity athletes. Previous research has shown that potential and actual body image stressors, in the presence of social-evaluation, have the ability to increase feelings of body-related shame and salivary cortisol in men (Lamarche et al., 2017; Smyth et al., 2020).

5.5 Implications

The current study provides a number of important implications for future body image and SSPT research. First, this study offers further support for the idea that male athletes and non-athletes experience meaningful and impactful body image concerns comparable to women (Chapman & Woodman, 2016; Fallon et al., 2014; Galli & Reel, 2009), and that further research needs to be taken in order to better understand the nature and magnitude of these concerns, as men have disproportionately been neglected within the body image field. Second, body image research as previously separated athletes on non-body image characteristics (e.g., ball-sport vs. endurance sport), have confounded competition with education level (e.g., high school vs. college vs. “elite”), and have inappropriately generalized previous athlete body image findings within a Canadian context (college athletics in USA ≠ college athletics in Canada; Hausenblas & Symons Down, 2001). This study helps to highlight the complex relationship that exists between athletes and their body image and provides evidence for the careful consideration of sport type and competition level when examining body image concerns in Canadian university athletes.

Within the context of SSPT, this study provides further evidence for the integration of the SSPT within a body image context by demonstrating the impact of body image SETs on non-athletes' and athletes' psychobiological response. Much of the SSPT literature has utilized performance-based SETs (i.e., speech tasks; Dickerson & Kemeny, 2004) however more recent studies, as well as the current one, add to the growing body of research that utilizes body specific SETs to study the acute effects and consequences of social-evaluation of the physique (Cloudt et al., 2014; Larmarche et al, 2016; Lamarche et al., 2017; Martin Ginis et al., 2014; Smyth et al., 2020). Future studies examining athlete responses to body image SETS should again be wary of how competition level and sport type are defined. Last, these findings also provide further support for the notion that *actual* (not anticipatory) body image stressors may be required to examine physiological changes (Lamarche et al., 2016; Lamarche et al., 2017; Smyth et al., 2020).

In addition, the current study provides evidence of the physiological consequences of acute body image stressors involving social-evaluation in male athletes and non-athletes. These social-evaluative body image threats, and subsequent physiological responses, may frequently occur within Western society as Western culture tends to place large amounts of importance and pressure on young people and athletes to meet body image ideals (Dotson, 1999; Galli & Reel, 2009; Lunde & Gattario, 2017; Tiggemen, 2011; Varnes et al., 2013). Failure to meet these ideals can result in social exclusion (Westermann, Rief, Euteneuer, & Kohlmann, 2015) and ridicule (Markham, Thompson, & Bowling, 2004), which may lead to increased feelings of body-related shame and subsequent cortisol responses. These body image stressors also exist within sport, though slightly differently depending on sport type and athlete status (Galli & Reel, 2009; Lunde & Gattario, 2017; Varnes et al., 2013), and findings from the present study suggest that athletes and coaches should be aware of the existence and potential consequences of body-related comments, stressors, and evaluation within the university sporting context. These body image stressors, when accompanied by social-evaluation, can evoke feelings of shame which may lead to avoidance behaviour (Leary, 1992) and distancing from sport in university athletes. Additionally, negative body-related stressors may accumulate over time in both athletes and non-athletes leading to lasting negative effects on the self-esteem of athletes and non-athletes (Fox, 1999), and negatively influencing the relation the athletes have with their given sport.

5.6 Limitations & Future Directions

This study is the first to examine psychobiological responses (i.e., body dissatisfaction and shame, and salivary cortisol) to, and recovery from, a SET in university athletes from non-aesthetic sports and non-athletes. Moreover, this is the first study to examine these types of responses to a body-specific SET and fills a gap from previous studies (Lamarche et al., 2016; Lamarche et al., 2017; Smyth et al., 2020) that excluded athletes due to their unique body image concerns.

Despite these strengths, the study is not without limitations. An important limitation is that the sample of participants was comprised of predominantly heterosexual Caucasian men, and thus, findings cannot be generalized to other sexualities or races. Another limitation is that including both varsity and club sport athletes from Canadian universities confounded competition level. Some studies (Hausenblas & Symons Downs, 2001; Varnes et al., 2013) suggest that athletes who compete at higher levels experience fewer body image concerns (e.g., greater body size and shape satisfaction and less general levels of body dissatisfaction). Certain university sports compete provincially as part of the *Ontario University Athletics* (OUA), while others have the opportunity to also compete nationally as part of *Usports*. Additionally, certain sports, such as ball hockey, ultimate frisbee, and dragonboat do not compete in the OUA or Usports. Thus, differences in competition level may influence body image pressures and concerns, and consequently psychobiological responses to body image SETs.

Another limitation is with our physiological measure of stress. Cortisol is a relatively unstable hormone that can be affected by many factors (e.g., diurnal rhythms, individual differences such as nutrition, physical activity, trait anxiety, and depression, perception of stressful stimuli). Thus, while measures were taken to reduce the amount of variablility that may occur (i.e., tests were post-poned if necessary to ensure no stressful events occurred on the day of testing and all testing occurred between 2 - 7pm when cortisol is at its lowest and most stable levels; Dickerson & Kemeny, 2004), it cannot be concluded for certain that cortisol fluctuations were due solely to the body image SET and not influenced by other variables. Next, while the athletes had significantly greater levels of physical activity, the non-athletes in the study were also very active, on average meeting physical activity MET minute recommendations per week (World Health Organization, 2018). It is possible that the athletes and non-athletes were too similar in terms of physical activity for any significant differences to be found.

Moreover, the recommented sample size as determined by a priori power analysis, was based on medium to large effect sizes found in previous studies that investigated only two-way interactions (i.e., time by condition). The current studied aimed to investigate a potential three-way interactions (i.e., time by condition by athlete status) and this analysis was most likely underpowered, as implied by the low observed power found in the analyzes. As such, small differences between the amateur athletes and non-athletes in the current study may have been present but remained undetected due to the limited sample size. However, it should mentioned that the observed power for the two-way interactions (i.e., time by condition), once athletes and non-athletes were combined into a single group, was sufficient.

Researchers should continue to examine psychobiological responses to body image SETs in more diverse samples in order to generalize findings to other populations. Gay men report higher body image concerns compared to heterosexual males (Morrison & McCutcheon, 2011). Other studies have found that African American individuals experience greater levels of positive body image and less negative body image compared to Caucasian samples (Bruns & Carter, 2015; van den Berg et al., 2010). Thus, it is possible that gay men may experience even greater psychobiological responses compared to their heterosexual counterparts, and that non-Caucasian participants could exhibit blunted responses. Researchers should also examine psychobiological responses to body image SETs in Usports athletes and compare them to OUA only athletes and non-exercisers in order to examine the unique influence of competition level. No studies have examined the effect of competition on the psychobiological responses to body image SETs of athletes.

5.7 Conclusion

The current study examined psychobiological responses to social-evaluative body image threats in male university athletes and non-athletes. This study found that male athletes and non-athletes exhibited similar increases in state body shame and salivary cortisol, but not body dissatisfaction, in response to the social-evaluative condition, with a return to baseline levels within 1 hour of the stressor onset. These results are partially consistent with previous literature suggesting that shame and cortisol are unique responses to social-evaluation and that amateur athletes exhibit similar responses compared to non-athletes (Dickerson & Kemeny, 2004; Dickerson et al., 2004; Rimmele et al., 2007; Rimmele et al., 2009). These findings are also consistent with previous body image literature, such that body-specific SETs increase body shame (Lamarche et al., 2017) and salivary cortisol (Lamarche et al., 2016; Lamarche et al., 2017; Smyth et al., 2020). Overall, these findings suggest that male university athletes are not immune to body image concerns or social-evaluation of the physique, and thus should continue to be investigated in a body image context. Future studies should continue to examine psychobiological responses in male and female athletes, between sports types (e.g., appearance focused vs. non-appearance focused vs. weight category), and over different levels of competition (i.e., competitive intramural sports vs. OUA vs. Usports), in order to further examine their effects on these responses.

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APPENDIX A: QUESTIONNAIRES

Demographic Questionnaire Pt. 1

Have you ever been diagnosed with a periodontal disease (e.g. gingivitis) or do you currently have any inflammatory conditions of the mouth (e.g. canker sores, ulcers, stomatitis, pericoronitis)? Yes____No ____

Have you ever been diagnosed with Hepatitis B? _

Do you smoke? _____

Are you on corticosteroids or anti-depressants? __

If so, please list the medications ___

Are you currently taking or have you ever taken anabolic steroids? _____

Did anything stressful or otherwise arousing happen to you earlier today or on your way

here? Yes___ No ___

If **yes**, please indicate what happened

Did you take any non-prescription medication earlier today (e.g. acetaminophen or anti-inflammatories)? Yes___ No _____
If **yes**, please indicate which one(s)

What time did you wake up this morning? _

Did you eat anything within one hour of this appointment? ________

Did you drink anything within one hour of this appointment? ___

Did you do any physical activity within one hour of this appointment? _

Demographic Questionnaire Pt. 2

Please complete the following Information:
Age: _

Major: ______

Ethnicity: ___

Sexual Orientation: _

Year of Study: _______

Varsity Sport (if applicable): _________________________

Did anything stressful or otherwise arousing happen to you earlier today or on your way

here? Yes___ No ___

If yes, please indicate what happened

Did you take any non-prescription medication earlier today (e.g. acetaminophen or anti-inflammatories)? Yes___ No _____
If yes, please indicate which one(s)

What time did you wake up this morning? _

Did you eat anything within one hour of this appointment? _______

Did you drink anything within one hour of this appointment? ___

Did you do any physical activity within one hour of this appointment? _

MBAS: Please read each item carefully then, for each one, check the box that best applies to you						
	1 Never	2 Rarely	3 Sometimes	4 Often	5 Usually	6 Always
I think I have too little muscle on my body						
I wish my arms were stronger						
I think my legs are not muscular enough						
I think my chest should be broader						
I think my shoulders are too narrow						
I think my arms should be larger (i.e. more muscular)						
I think my calves should be larger (i.e. more muscular)						
I think my back should be larger and more defined						
I think my chest should be larger and more defined						
I feel satisfied with the definition in my arms						

SATAQ – 4: Please read each of the following items carefully and check the box t vest reflects your agreement with the statement					
	Disagree	Mostly Disagree	Neither Agree nor Disagree	Mostly Agree	Definitely Agree
It is important for me to look athletic					
I think a lot about looking muscular					
I spend a lot of time doing things to look more athletic					
I think a lot about looking athletic					
I spend a lot of time doing things to look more muscular					

International Physical Activity Questionnaire (short)

The questions are about your time you spent being physically active in the last 7 days. They include questions about activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Please answer each question even if you do not consider yourself to be an active person.
In answering the following questions,

x Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

x Moderate physical activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

1a. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

Think about ONLY those physical activities that you did for at least 10 minutes at a time.

______ days per week ⇨ 1b. How much time in total did you usually spend on one of those days during vigorous physical activities?

_______hours _________minutes

OR

☐ None

2a. Again, think ONLY about those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you domoderate physical activities like carrying light loads, bicycling at a regular pace, or doubles in tennis? DO NOT include walking.

______ days per week ⇨ 2b. How much time in total did you usually spend on one of those days during moderate physical activities?

_______hours _________minutes

OR

☐ None

3a. During the last 7 days, on how many days did you walk for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for recreation, sport, exercise or leisure.

______ days per week ⇨ 3b. How much time in total did you usually spend walking on one of those days

_______hours _________minutes

OR

☐ None

BISS

For each of the items below, check the box beside the one statement that best describes how you feel RIGHT NOW AT THIS VERY MOMENT. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.

Right now I feel...
□ Extremely dissatisfied with my physical appearance
□ Mostly dissatisfied with my physical appearance
□ Moderately dissatisfied with my physical appearance
□ Slightly dissatisfied with my physical appearance
□ Neither dissatisfied nor satisfied with my physical appearance
□ Slightly satisfied with my physical appearance
□ Moderately satisfied with my physical appearance
□ Mostly satisfied with my physical appearance
□ Extremely satisfied with my physical appearance

Right now I feel...
□ Extremely satisfied with my body size and shape
□ Mostly satisfied with my body size and shape
□ Moderately satisfied with my body size and shape
□ Slightly satisfied with my body size and shape
□ Neither dissatisfied nor satisfied with my body size and shape
□ Slightly dissatisfied with my body size and shape
□ Moderately dissatisfied with my body size and shape
□ Mostly dissatisfied with my body size and shape
□ Extremely dissatisfied with my body size and shape

Right now I feel...
□ Extremely satisfied with my weight
□ Mostly satisfied with my weight
□ Moderately satisfied with my weight
□ Slightly satisfied with my weight
□ Neither dissatisfied nor satisfied with my weight
□ Slightly dissatisfied with my weight
□ Moderately dissatisfied with my weight
□ Mostly dissatisfied with my weight
□ Extremely dissatisfied with my weight

Right now I feel...
□ Extremely physically attractive
□ Very physically attractive
□ Moderately physically attractive
□ Slightly physically attractive

□ Neither attractive nor unattractive
□ Slightly physically unattractive
□ Moderately physically unattractive
□ Very physically unattractive
□ Extremely physically unattractive

Right now I feel...
□ A great deal worse about my looks than I usually feel
□ Much worse about my looks than I usually feel
□ Somewhat worse about my looks than I usually feel
□ Just slightly worse about my looks than I usually feel
□ About the same about my looks than I usually feel
□ Just slightly better about my looks than I usually feel
□ Somewhat better about my looks than I usually feel
□ Much better about my looks than I usually feel
□ A great deal better about my looks than I usually feel

Right now I feel I look...
□ A great deal better than the average person looks
□ Much better than the average person looks
□ Somewhat better than the average person looks
□ Just slightly better than the average person looks
□ About the same as the average person looks
□ Just slightly worse than the average person looks
□ Somewhat worse than the average person looks
□ Much worse than the average person looks
□ A great deal worse about than the average person looks

WBRSG-BS

Read each of the following statements carefully and circle the appropriate value following each statement.

0 = Strongly disagree 1 = Disagree 2 = Neither agree or disagree 3 = Agree 4 = Strongly agree

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
1. Right now, I feel ashamed because others can see my body.	0	1	2	3	4
2. Right now, the appearance of my body is embarrassing for me in front of others.	0	1	2	3	4
3. Right now, I would rather hide somewhere because others can see my body.	0	1	2	3	4
4. Right now, I would be ashamed of myself if others knew how much I really weighed.	0	1	2	3	4
5. Right now, I would feel embarrassed if I had to physically exert myself in front of others.	0	1	2	3	4
6. Right now, the size of my clothes is embarrassing for me.	0	1	2	3	4

Perceptions: Male Participant

How close was the other male participant to your perceptions of the muscular ideal?

0 = not at all my perceptions of the muscular ideal

1

2

3

4 = my exact perceptions of the muscular ideal

Perceptions: Female Research Assistant

How attractive do you perceive the female research assistant who took your measurements?

0 = not at all attractive

1

2

3

4 = very attractive

Have you had any of the following anthropometric measures taken previously?

If yes, circle all that apply:

- Biceps circumference
- Waist circumference
- Chest circumference
- Skinfold testing for body composition assessment
- Underwater weighing
- Bioelectrical impedance
- Handgrip strength

Appendix B: Certificate of Ethics Clearance for Human Participant Research

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Bioscience Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE:	11/6/2017
PRINCIPAL INVESTIGATOR:	GAMMAGE, Kimberley - Kinesiology
CO-INVESTIGATOR(S):	Cameron Muir (cmuir@brocku.ca)
FILE:	17-083 - GAMMAGE
TYPE:	Masters Thesis/Project STUDENT: David Brown SUPERVISOR: Kimberley Gammage

TITLE: An Examination of Physical Characteristics, Mental Health, and Psychobiological Markers in University Male Athletes and Non-Exercisers

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 11/1/2018

The Brock University Bioscience Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from **11/6/2017** to **11/1/2018**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 11/1/2018. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Sandra Peters, Chair
Bioscience Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.