FACTORS RELATED TO BODY IMAGE AMONG PEOPLE WITH SPINAL CORD INJURY

THE RELATIONSHIPS BETWEEN BODY IMAGE, LEISURE TIME PHYSICAL ACTIVITY AND BODY COMPOSITION AMONG PEOPLE LIVING WITH SPINAL CORD INJURY

By

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A Thesis

Submitted to the School of Graduate Studies

in Partial Fulfillment of the Requirements

for the Degree

Master of Science in Kinesiology

McMaster University

MASTER OF SCIENCE (2007) McMaster University
(Kinesiology) Hamilton, Ontario

TITLE: The Relationships Between Body Image, Leisure Time Physical Activity, And Body Composition Among People Living With Spinal Cord Injury

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NUMBER OF PAGES: vii, 101

Abstract

Body image is an important component of physical and psychological health. Cash's (2002) cognitive-behavioural model of body image is useful for understanding factors related to body image, such as body composition and leisure time physical activity (LTPA). Changes in body composition and LTPA following spinal cord injury (SCI) may increase the risk of developing an unhealthy body image and may jeopardize the overall health and well-being of people with SCI. Unfortunately, little research had been conducted to explore factors related to body image in the SCI population.

The object of the current thesis was to examine body image in people with SCI, within the framework of Cash's (2002) model. Specifically, we examined the relationships between appearance and functional satisfaction, LTPA, and body composition in 61 men and women with SCI. Pearson's correlations were calculated to examine the relationship between body composition and body satisfaction. In order to compare body satisfaction between men and women who engaged in *some LTPA* versus *no LTPA*, separate 2 (sex) x 2 (LTPA) ANOVAs were calculated for appearance satisfaction and functional satisfaction.

We hypothesized that body composition would be negatively related to appearance satisfaction and functional satisfaction such that higher body weight, percentage body fat and waist circumference would be associated with lower levels of satisfaction. Further, we hypothesized that after controlling for body composition, participants who engaged in LTPA would have more appearance and functional satisfaction than those who did not.

Finally, we hypothesized that body satisfaction would be more strongly related to moderate-intensity LTPA versus mild-intensity LTPA, and resistance-LTPA versus aerobic-LTPA.

In partial support of our hypothesis, body composition was significantly related to appearance satisfaction for women only. Body composition was not significantly related to functional satisfaction for men or women. The results of the ANOVAs indicate that women were more dissatisfied with their appearance than men. However, contrary to hypothesis, appearance satisfaction did not differ between men or women who engaged in LTPA versus those who did not. For men and women, those who engaged in mild or moderate intensity LTPA were less satisfied with their physical function than those who did not. Further, participants who engaged in resistance-LTPA were less satisfied with their physical function that those who did not.

Results are discussed within the framework of Cash's model. Findings suggest that people who engage in LTPA are less satisfied with their bodies than people who do not. This finding was surprising because LTPA has been shown to improve body image in the SCI population (Hicks et al., 2003). However, dissatisfaction with physical appearance or physical function may motivate individuals to engage in LTPA. The theoretical and practical implications of the current thesis are discussed. Prospective research is necessary to further understand the directionality of the relationship between the constructs of Cash's (2002) model, and to test SCI-specific variables as potential mediators and moderators of the relationship between LTPA and body image.

Acknowledgements

Dr. Kathleen Martin Ginis: To teach is to guide, to impart knowledge, and to instruct by example. You have taught me more than you can imagine – both within and beyond the walls of McMaster University. The only way I can explain my good fortune in working with you is serendipity. I am truly blessed and finally have found someone in this world appreciates my idiosyncrasies (e.g., my love for spreadsheets, lists, colour-coding, and schedules)! I hope that I can make you proud over the course of my academic career. I look forward to working with you in the future. I can only hope that one day I will be half the teacher (and woman) you are. Thank you for everything.

My thesis committee: Thank you for the time, energy and enthusiasm you have given. I admire each of you and look forward to working with you in the future.

My lab mates: I cannot imagine graduate school without the support of a lab group like ours. You guys have made this experience possible and enjoyable. I look forward to future opportunities to work with you all. Thank you for your support and friendship.

Iwona Chudzik: Thank you for the energy and dedication you have given to this project. I cannot wait to publish our first book "The Adventures of Rebecca and Iwona." I am fortunate to have made such a good friend throughout our journeys.

Dr. Audrey Hicks: Thank you for giving me the opportunity to work with the unique and wonderful SCI population. My life has change immensely since the first day I joined the MacWheelers team. I look forward to working with you throughout my upcoming years at McMaster.

My family: It is wonderful to be surrounded by people who love and support you no matter what. I am lucky to have a family that have accepted my grouchiness and anxiety throughout the process of writing and preparing my thesis. I thank you each for believing in me and teaching me the power of determination. ☆

Justin: I probably would not be here if it were not for you. You believed in me when I did not believe in myself. You have coached me through many borderline anxiety attacks and late-night freak outs. I must thank you for loving and supporting me in spite of my type-A traits that have shone brightly in the past year. And just think...at least 3 more years ahead! You have taught me what is important in life and that is a gift for which I will be forever thankful.

Table of Contents

Body image is a multidimensional construct that reflects how we see our own body, and how we think, feel, and act toward it (Thompson et al., 1999). Body image disturbance occurs when an individual has negative experiences along any of the body image dimensions. For example, inaccurate perceptions of the size or shape of one's body, or cognitive-evaluative dissatisfaction with one's body are two indications of body image disturbance (Cash & Deagle, 1997). Body image disturbance has been found to be a principal component and predictor of numerous health problems including obesity, depression (for a review, see Hausenblas & Fallon, 2006), and anxiety (Sands & Wettenhall, 2000). Further, body image disturbance can result in social introversion (Sands & Wettenhall), interference with activities of daily living (ADL), and impedance of work roles (Yuen & Hanson, 2002).

Recent research has demonstrated the importance of body image to people with chronic disease and disability (e.g., Pruzinsky, 2004; Taleporos & McCabe, 2001, 2002). Pain, loss of function or mobility, and changes to appearance that may accompany disease and disability can alter the psychological experience of the body (Pruzinsky). The experience of the body can play a significant role in the lives of people with disease and disability as changes to body image can affect one's psychological, physical and social well-being (Taleporos & McCabe).

Individuals with spinal cord injury (SCI) are an example of a disabled population that may be at risk for body image disturbance. Compared to the general population, people with SCI already experience an increased prevalence of health problems such as obesity, anxiety and depression (for a review, see Martin Ginis & Hicks, in press). Given that

body image disturbance can jeopardize physical and psychological health, understanding and modifying factors related to body image in people with SCI may be an important step toward improving overall health within this population. As such, the purpose of this thesis is to examine the relationships between body image, body composition, and physical activity among individuals with SCI.

Due to the multidimensional nature of body image and its many possible antecedents and consequences, it is helpful to use a theory or model to guide the study of body image in relation to other constructs such as body composition and physical activity. A theory or model can provide an understanding of *how* other constructs are related to body image. Further, a theoretical framework can assist in understanding complex psychosocial concepts--such as body image--within a physical activity-related context. Theory-driven research can also provide a blueprint to guide and advance practical physical activity interventions (Brawley, 1993) to promote physical and psychological health through the improvement of body image. Yet despite the practicality of theory-driven research, to date, what little research that has been conducted on body image among people with SCI, has been atheoretical. In order to address this limitation, Cash's (2002) cognitive-behavioural model of body image will provide a theoretical framework for the current thesis. Cash's (2002) model was chosen as the framework for the current thesis because it is specific to the attitudinal dimension of body image. Due to the complexity and multidimensionality of body image, it made sense to focus on one specific dimension of body image versus multiple dimensions. Further, unlike many other psychosocial models used to examine body image, Cash's model explores modifiable constructs such as

physical characteristics and self-regulatory behaviours. Understanding the relationship between body image and constructs that are modifiable may be useful in the development of interventions to improve body image. Finally, Cash's model was chosen as it seemed appropriate for exploring body image in the SCI population as the model examines factors such as physical activity and body composition that are affected by SCI.

A Cognitive-Behavioural Model of Body Image

In 2002, Thomas Cash proposed a cognitive-behavioural model of body image (Figure 1). The model focuses on factors that can influence "body image evaluation." Body image evaluation refers to one's satisfaction with his or her body, and captures both satisfaction with physical function and physical appearance. According to Cash's model, body image evaluation develops as a result of historical influences and proximal processes.

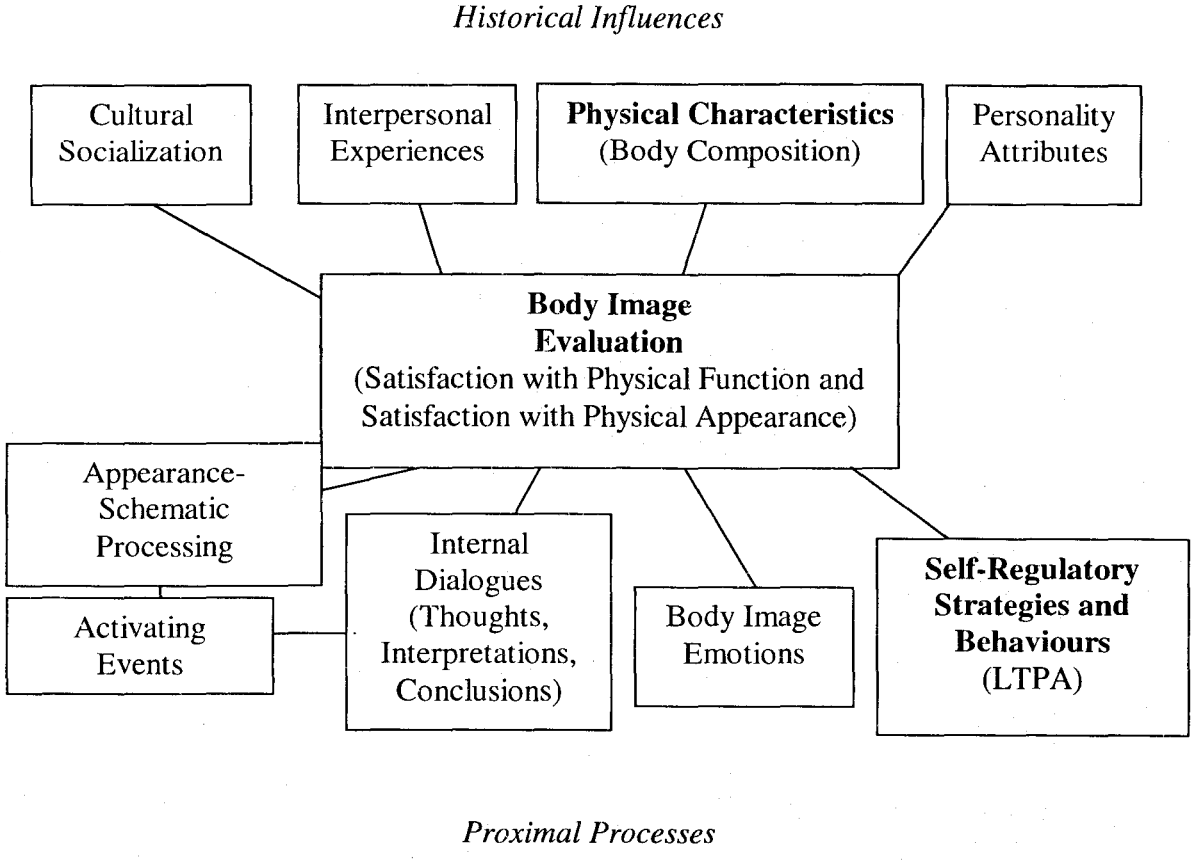

Figure 1. Cash's (2002) Cognitive-Behavioural Model of Body Image.

Cash (2002) explains that *historical or developmental influences* include past events, attributes, and experiences that predispose or influence how people come to think, feel, and act in relation to their bodies. Although there are several historical influences within the model, for the purpose of this thesis, only physical characteristics (e.g., body composition) will be examined. Specifically, the relationship between body composition and body image evaluation will be explored.

Cash (2002) refers to *proximal events and processes* as current life events that precipitate and preserve an individual's body image evaluation. Although there are several events and processes that can influence body image evaluation, within the context of this thesis, only self-regulatory strategies and behaviours will be assessed. Specifically, physical activity will be considered as a self-regulatory strategy and behaviour. The relationship between leisure time physical activity (LTPA) and body image evaluation will be examined.

In the next section, background information on SCI will be presented followed by a discussion of the importance of body image research within the SCI population.

What is a Spinal Cord Injury (SCI)?

SCI refers to a lesion to the spinal cord, which results in sensory and/or motor impairment below the level of the lesion. SCI is most often classified by the level at which the lesion occurs. Quadriplegia refers to a lesion in the cervical region of the spinal cord, which can result in impairment to function of the arms, trunk, pelvis, and legs of the individual. Alternatively, paraplegia refers to a lesion to the spinal cord below the cervical segments (i.e., thoracic, lumbar, or sacral region), which does not affect arm

function. Depending on the level of the injury, people with paraplegia may face impaired function in the trunk, pelvis and legs (Canadian Paraplegic Association [CPA], 2007a).

SCI can also be classified by the severity of the injury. A complete injury is one that results in no functional sensory or motor preservation at the sacral level of the spinal cord. Alternatively, an incomplete injury is characterized by some sensory or motor preservation at the sacral level (CPA). Regardless of the level or severity of injury, SCI results in drastic changes to an individual's body. In fact, SCI can affect every system of the body (Somers, 1992).

There are currently 40,000 Canadians living with SCI and approximately 1050 new injuries occur in Canada each year (CPA, 2007b). Approximately 81% of SCIs are experienced by men (CPA, 2000) and the modal age at the time of injury is approximately 19 years (National Spinal Cord Injury Association, 2006). Given the relatively young age at which SCIs typically occur, coupled with the fact that people with SCI live almost as long as those without, there is a need for research to examine strategies to maximize psychological well-being across the lifespan.

Why study body image in people with SCI?

SCI is usually the result of a trauma (e.g., motor vehicle mishap, fall, diving accident) and therefore occurs in an instant (CPA, 2007b). However, the physical and psychological repercussions of SCI can last a lifetime. Research regarding body image is lacking in the SCI literature. Yet in general, physical disabilities have been shown to negatively impact body image (Taleporos & McCabe, 2001). For example, a qualitative study of 35 individuals with various disabilities (e.g., SCI, multiple sclerosis, muscular

dystrophy) found that physical disability often results in negative thoughts and feelings toward the body, especially regarding perceived physical attractiveness (Taleporos & McCabe).

Although people with SCI have been included in studies examining body image in the disabled population in general, research is needed to focus on people with SCI in particular. SCI is a unique disability and therefore must not be grouped with other disabilities when examining body image. For example, unlike degenerative or progressive disabilities (e.g., multiple sclerosis), the instantaneous nature of SCI leaves no opportunity for psychological adjustment to changes in the body. As such, the impact of SCI on body image may vary drastically from that of other disabilities. Furthermore, the SCI population is unique in that approximately 80% of the population is male (CPA, 2000). Body image may vary between men and women (Lox et al., 2003) and therefore the results of research on body image in the SCI population may differ from that of other populations.

The few studies that have been conducted in the SCI population suggest that body image may be negatively impacted by SCI (e.g., Romeo, Wanlass & Arenas, 1993). One of the largest studies to examine body image in the SCI population was conducted by Romeo et al. and included 47 male participants with paraplegia and quadriplegia. The men completed the Derogatis sexual function inventory questionnaire including the body image subscale. The body image scores for the men in this study were significantly lower than normative scores for non-disabled men.

A negative change in perceived attractiveness has been the most common finding regarding body image among individuals who have incurred a disability such as SCI (e.g., Kettl et al., 1991). Kettl et al. found that a decrease in perceived attractiveness was the largest change following SCI, as reported by 27 women with SCI. This study used a mailed questionnaire to examine issues such as body image that are related to sexual functioning following SCI. The participants in the previously-cited qualitative study by Taleporos and McCabe (2001; n=35), also reported feeling much less attractive than prior to their injury. In addition, feelings of discomfort, embarrassment and emotional distress resulting from body image disturbance have been commonly expressed by individuals with SCI (e.g., Taleporos & McCabe). Feelings of discomfort or embarrassment may partially explain the findings of a study by Yuen & Hanson (2002) where the mutlidimensional body-self relations questionnaire was used to compare the body image of 30 individuals with a traumatic mobility disability (AMD: 77% with SCI) with that of 30 able-bodied individuals (AB). Although many aspects of body image were similar between the groups (AMD vs. AB), the AMD group had significantly higher scores on appearance orientation. This indicated that the individuals with AMD found appearance orientation to be more important and they paid more attention to appearance than the AB individuals. Feelings of discomfort, embarrassment or distress may have lead the individuals in the AMD group to pay more attention to their appearance and place more value on their appearance than individuals in the AB group who may not have felt embarrassed or uncomfortable with their appearance.

Cash's (2002) cognitive-behavioural model identifies two key factors that may explain the observed negative impact of SCI on body image. First, SCI results in drastic changes to an individual's physical characteristics (e.g., body composition). For individuals living with SCI, paralysis and reductions in physical activity often result in increased fat mass and reduced muscle mass (Jones, Legge & Goulding, 2003). Changes in body composition such as body weight or muscle mass can greatly influence body image evaluation (Cash & Pruzinsky, 2002). Second, levels of physical activity are often considerably diminished following SCI. Compared to 35% of the able-bodied population (Craig & Cameron, 2004), approximately 50% of people with SCI engage in no physical activity whatsoever (Tasiemski et al., 2000). In fact, the SCI population is one of the most physically inactive segments of society (Dearwater et al., 1985). Physical activity has been found to have a positive effect on body image and can greatly impact how an individual thinks, feels and acts towards his or her body (Tucker & Mortell, 1993). Together, changes in body composition and changes in physical activity levels following SCI may explain the possible negative influence of SCI on body image.

In summary, in light of previous research suggesting a negative impact of SCI on body image, and the physical and psychological health implications related to body image disturbance, further research is necessary in order to better understand factors related to body image in people with SCI. Limitations such as small and non SCI-specific samples have minimized the conclusions that can be drawn from existent research. Furthermore, previous research has focused almost exclusively on body image in relation to physical appearance, while overlooking the importance of body image related to physical function.

These weaknesses highlight the importance of SCI-specific research for understanding body image within this unique population. In fact, research regarding body image in specific disabled populations (e.g., SCI) is one of the most important, albeit neglected areas of research in the body image literature (Pruzinsky, 2004).

Considerations for Studying Body Image in People with SCI

One weakness in the existent literature on body image following SCI, is the near exclusive focus on body image with regard to satisfaction with physical appearance and a lack of attention to satisfaction with physical function. Physical function and appearance have been shown to be two independent aspects of adults' body satisfaction (Reboussin et al., 2000). The measurement of both aspects may be an important consideration when studying body image in people with SCI, as both physical function and physical appearance can be affected by their injury.

It is also important to consider characteristics of the individual and the injury when examining body image in people with SCI. For example, age of onset of disability may be significantly related to body image (Pruzinsky, 2004). Indeed, age of onset has been found to correlate negatively with concerns about weight and shape, such that people injured at a younger age are likely to experience more distressing thoughts and feelings about their bodies than people injured at an older age (Ben-Tovim & Walker, 1995). With time however, people may better accept their disability, thus, negative body image evaluation may improve over time (Taleporos & McCabe, 2002).

Current age may also be related to body image although the nature of this relationship is unclear (Reboussin et al., 2000). Multiple regression analyses found a negative

relationship between age and body dissatisfaction in a group of able-bodied adult women (Davis et al., 1994) suggesting that with age, women become less dissatisfied with their bodies. However, other studies of both able-bodied men and women have found no relationship between body image and age (e.g., Cash & Henry, 1995). There is no known research on the relationship between age and body image in the SCI population.

The level and completeness of SCI may also be related to body image, as an individual with quadriplegia or complete SCI may experience a greater degree of physical changes to body composition than an individual with paraplegia or incomplete SCI. For example, individuals with quadriplegia may have higher levels of regional fat mass and lower levels of regional lean tissue than people with paraplegia in areas such as the arms (Spungen et al., 2003). Likewise, individuals with complete injuries generally have lower levels of lean tissue mass and higher levels of absolute fat mass than individuals with incomplete injuries (Spungen et al.). Of course, more severe physical changes could result in more severe changes to one's body image evaluation. Although the impact of injury level and completeness on certain aspects of body composition has been demonstrated, it should be noted that other measures of body composition (e.g., weight and body fat percentage) were not significantly different between people with paraplegia and quadriplegia, or people with complete and incomplete injuries in a single study examining body composition in people with SCI (Spungen et al.). Therefore, body image may or may not differ between people with injuries of various levels and completeness, but these are factors that certainly warrant consideration in studies of body image among people with SCI.

Finally, sex is an important factor to take into account as body composition ideals and body satisfaction may vary between men and women. Body image disturbance has often been considered more prevalent in women than men (Smith et al., 1999). Interestingly, however, research has shown that women with physical disabilities worry less about small changes to their weight and shape than women without physical disabilities (Ben-Tovim & Walker, 1995), and that women are generally more accepting of the consequences of SCI than men (North, 1999). Given these previous research findings, the participants' sex may be an especially important consideration when examining body image in people with SCI. The prevalence of body dissatisfaction may differ between men and women with SCI compared to that of the general population. Furthermore, because the SCI population is approximately 80% male, an analysis that fails to consider sex is likely to be misleading regarding body image within the population.

In the next section, a review of literature is presented examining body image evaluation in relation to body composition and LTPA. Literature reflecting research in the general population, as well as the SCI population, will be reviewed.

The Relationship Between Body Composition and Body Image Evaluation

A key construct within the cognitive-behavioural model of body image (Cash, 2002), is the physical characteristics (i.e., body composition) of an individual's body. Body composition is proposed to influence one's satisfaction with physical appearance based on Lerner and Jovanovic's goodness-of-fit model (1990). According to the goodness-of-fit model, appearance-related body image evaluation is dependent upon a comparison between an individual's actual or perceived body composition and societal or internalized

standards (Cash). If an individual's self-appraisal does not match his or her standards, the result may be dissatisfaction with physical appearance or a negative body image evaluation.

Current societal standards endorse a thin physique for women (Striegel-Moore & Franko, 2002), and a lean and muscular physique for men (Pope, Olivardia, Gruber & Borowiecki, 1999). With the current societal standards in place, it is not surprising that a negative correlation between percentage of body fat and appearance satisfaction has been demonstrated in women of all ages, with fatter women feeling less satisfied with the appearance of their bodies than thinner women (Davis, Durnin, Dionne & Gurevich, 1994). Likewise, increased perceptions of muscularity were associated with an increase in body areas satisfaction in a study of young men, suggesting that more muscular men feel better about the appearance of their bodies than less muscular men (Martin Ginis et al., 2005). Furthermore, subjective changes in body composition as measured by changes in perceived body fat, muscularity and strength, significantly predicted changes in body image among both men and women (Martin Ginis et al.). Taken together, these studies suggest that appearance-related body image evaluation is strongly related to body composition.

As previously discussed, a SCI results in changes to one's body composition. As Cash's (2002) model posits, these changes in body composition may explain the observed negative impact of SCI on appearance-related body image evaluation (e.g., Romeo & Arenas, 1993; Yuen & Hanson, 2002). Living in a society which values physical characteristics that are essentially unachievable for someone with a SCI (i.e., lean and

thin physique for women, "six-pack" abs and bulging biceps for men; Hoyt & Kogan, 2002) may contribute to the difficulty of upholding a positive body image following SCI (Taleporos & McCabe, 2001, 2002).

Body composition may also relate to functional body image evaluation. For example, an individual with a healthier body composition (i.e., lower body weight, lower body fat percentage, smaller waist circumference) may experience less difficulty with performing certain physical tasks (e.g., Coakley et al., 1998) and may perceive higher levels of energy (Fontaine et al., 1999) or endurance than an individual with a less healthy body composition. In turn, greater endurance, energy, and perceived ease of performing physical tasks are likely to enhance satisfaction with physical function. Accordingly, body mass index and body fat have been found to correlate negatively with satisfaction with physical function (Reboussin et al., 2000). Taken together, these findings provide support for Cash's (2002) model, by highlighting the role of body composition in the development of body image evaluation with regards to physical function.

In summary, research in the general population has shown a definite role for body composition in the development of body image evaluation. However, the relationship between body composition and body image evaluation of people with SCI has not yet been examined. The present thesis represents an important step towards addressing this void in the SCI research literature.

The Relationship Between Leisure Time Physical Activity and Body Image Evaluation

Cash's (2002) model of body image includes self-regulatory behaviours and strategies as a proximal influence on body image evaluation. Such behaviours and strategies include

actions that are used to manage distressing thoughts and feelings that accompany body image disturbance. LTPA is an example of a behaviour that may be considered a coping strategy for individuals with body image disturbance. LTPA includes any physical activity that individuals choose to do in their free time (Bouchard & Shephard, 1994).

Indeed, a meta-analysis of 121 studies found that LTPA in the form of exercise improved body image across a variety of samples (e.g., men and women, samples that varied in age, social economic status, ethnicity etc.; Hausenblas & Fallon, 2006). Specifically, people who participated in LTPA had a more positive body image when compared to those who did not participate in LTPA. Furthermore, those who participated in a LTPA intervention reported significant improvements in body image following the intervention.

With regard to the most effective types of LTPA, meta-analytic findings suggest that a combination of anaerobic (i.e., resistance-LTPA) and aerobic-LTPA has a greater effect on body image evaluation than either mode of LTPA independently (Hausenblas & Fallon). However, when the effects of resistance and aerobic-LTPA were compared in a single study, resistance-LTPA was shown to have a greater effect on body image than aerobic-LTPA (e.g., Tucker & Mortell, 1993). Moderate and heavy intensity level LTPA interventions were also found to have a significantly larger effect on body image evaluation than mild intensity level LTPA interventions (Hausenblas & Fallon).

There has been little investigation of the effects of LTPA on body image evaluation in people with SCI. However, a few studies have been conducted that suggest LTPA is an important influence on body image evaluation in the SCI population. For example, an

exercise training study found improved satisfaction with physical function and appearance for exercisers with SCI (n= 11) compared to sedentary controls (n=12; Hicks et al., 2003). In another study, 4 men with cervical SCI who participated in resistance-LTPA reported enhanced confidence and body image evaluation (Wise, 2000). Likewise, 17 individuals with acquired mobility disability (AMD; primarily SCI) who participated in LTPA reported greater satisfaction with physical appearance compared to 13 people with AMD who did not participate in LTPA (Yuen & Hanson, 2002). These findings suggest that LTPA may be influential in the development of positive body image evaluation among individuals with SCI.

We are unaware of any research in the SCI population that has explored specific modes and intensities of LTPA in relation to body image evaluation. However, given that resistance-LTPA has shown to be superior to aerobic-LTPA in direct comparisons of the two modalities in the general population, it is expected that resistance-LTPA will be superior to aerobic-LTPA for people with SCI as well. Likewise, there is no empirical evidence to suggest that the relationship between the intensity of LTPA and body image evaluation would differ between the general population and the SCI population. Thus, it is expected that moderate and heavy intensity LTPA will have a stronger relationship with body image evaluation than mild intensity LTPA for people with SCI.

Leisure Time Physical Activity, Body Composition and Body Image Evaluation

Cash's (2002) model includes both body composition and LTPA as variables related to body image. As such, it seems plausible that there is a relationship between body composition, LTPA, and body image. The relationship between the three variables may

partially explain *how* LTPA and body image are related. It has been suggested that LTPA may influence body image evaluation through changing an individual's body composition. Empirically, objective changes in body composition have been well examined as a possible mechanism of exercise-induced changes in body image evaluation (e.g., Martin & Lichtenberger, 2002; Martin Ginis et al., 2005). This is a reasonable explanation for the effects of LTPA on body image evaluation, as LTPA can produce a body composition more closely related to cultural ideals and thus decrease body dissatisfaction (Martin Ginis et al.). Congruent with the goodness-of-fit model (Lerner & Jovanovic, 1990), these improvements in body composition may lead to a reduction in distressing thoughts and feelings about one's body. As such, this may serve as a positive reinforcement for LTPA as a self-regulatory strategy in relation to body image evaluation.

Changes in body composition may have an important role in explaining the effects of LTPA on body image evaluation in people with SCI as well. As previously discussed, the negative changes in body composition that may follow SCI can largely influence how an individual feels about his or her body. In fact, changes in body composition may be the principal factor in the development of body image evaluation following SCI. Therefore, since body composition is such an important aspect of body image evaluation in people with SCI, it is probable that changes in body composition following LTPA, such as decreased fat mass and increased muscle mass, may explain the effects of LTPA on body image evaluation that has been demonstrated in previous SCI literature (e.g., Hicks et al., 2003; Martin Ginis et al., 2003).

Although the notion of body composition as a mechanism to explain the effects of LTPA on body image evaluation is intuitively and empirically sound, it should be noted that objective measures of body composition are not the only mechanism through which LTPA affects body image evaluation (Martin & Lichtenberger, 2002). Changes in body composition following LTPA generally explain less than 10% of the variance in body image evaluation scores (for a review, see Martin & Lichtenberger) and certainly cannot fully explain the effect of LTPA on body image evaluation that has been seen in previous research. Consequently, even after controlling for body composition, an association between LTPA and body image evaluation is expected.

Summary and Rationale

Theory-driven research is needed to better understand body image evaluation in the SCI population. Cash's (2002) cognitive-behavioral model of body image is a useful framework for understanding body image evaluation in people with SCI. An improved understanding of the interplay between body composition, LTPA, and body image evaluation can further the development of treatment for body image disturbance in the SCI population. Because body composition and LTPA are potentially modifiable, understanding the relationship between body composition, LTPA and body image evaluation may provide insight into the development of interventions to improve body image disturbance in the SCI population.

Previous research has found that body composition is related to body image evaluation in the general population (Davis et al., 1994); however, this relationship has not been examined in the SCI population. Furthermore, although LTPA has been shown

to be positively correlated with body image evaluation for the SCI population, the specific modes and intensities of LTPA in relation to body image evaluation are not known. Another weakness of the SCI body image literature is the unbalanced focus on satisfaction with physical appearance. These shortcomings will be addressed in the current thesis.

Hypotheses

1) a) For men and women, body composition will be negatively related to satisfaction with physical appearance such that higher body weight, percentage body fat, and waist circumference will be associated with lower levels of satisfaction with physical appearance.

   b) After controlling for body composition, men and women who engage in LTPA will have more satisfaction with physical appearance than those who do not engage in LTPA.

2) a) For men and women, body composition will be negatively related to satisfaction with physical function such that higher body weight, percentage body fat, and waist circumference will be associated with lower levels of satisfaction with physical function.

   b) After controlling for body composition, men and women who engage in LTPA will have more satisfaction with physical function than those who do not engage in LTPA.

3) Body image will be more strongly related to moderate intensity LTPA than mild intensity LTPA such that:

   a) The difference in satisfaction with physical appearance between men and women who engage in *moderate* LTPA versus those who do not, will be greater than the difference between those who engage in *mild* LTPA versus those who do not.

b) The difference in satisfaction with physical function between men and women who engage in *moderate* LTPA versus those who do not, will be greater than the difference between those who engage in *mild* LTPA versus those who do not.

4) Body image will be more strongly related to *resistance-LTPA* than *aerobic-LTPA* such that:

a) The difference in satisfaction with physical appearance between men and women who engage in *resistance*-LTPA versus those who do not, will be greater than the difference between those who engage in *aerobic-LTPA* versus those who do not.

b) The difference in satisfaction with physical function between men and women who engage in *resistance*-LTPA versus those who do not, will be greater than the difference between those who engage in *aerobic-LTPA* versus those who do not.

Method

Participants

Participants were drawn from the larger *Study of Health and Activity in People with Spinal Cord Injury (SHAPE-SCI).* All participants in the *SHAPE-SCI* that lived within 200km of McMaster University and were recruited by McMaster or Parkwood sites were invited to participate in an associate study in which home-based testing took place in order to measure chronic disease risk factors. As LTPA and measures of body composition were already part of the *SHAPE-SCI* protocol, the additional body image evaluation measures for the current study were added to the home-based testing sessions. This procedure was approved by the Hamilton Health Sciences and McMaster University Research Ethics Boards. Participants were required to sign a detailed consent form confirming their voluntary participation and the confidential nature of data collection (Appendix A).

As per *SHAPE-SCI* inclusion criteria, participants had incurred a traumatic SCI at least 12 months prior to recruitment, were at least 18 years of age, and relied on an assistive device for mobility outside of the home (e.g., manual or power wheelchair). Participant recruitment aimed to reflect the demographics of the overall Canadian SCI population (i.e., approximately 50% with quadriplegia, and 80% male; CPA, 2000). For complete participant demographic information refer to Table 1.

Sample size was calculated using power analyses for 2 (sex) x 2 (LTPA) ANOVAs. According to Cohen (1992), approximately 60 participants are needed to have 80% power ($\alpha = .10$) to detect a large effect size for LTPA as a predictor of satisfaction with physical

function and satisfaction with physical appearance between the four groups. A p value of .10 was chosen for the ANOVAs due to the exploratory nature of the thesis and the small number of female participants resulting in low power for analyses involving sex. A large effect size was anticipated for LTPA based on meta-analytic findings showing a large correlational relationship between LTPA and body image evaluations (Hausenblas & Fallon, 2006).

Table 1

Participant Demographic Characteristics

Variable	
Sex	
Male	50 (82%)
Female	11 (18%)
Age (yr)	
Age at time of Testing	41.77 ± 11.79
Age at time of Injury	26.70 ± 10.77
Years post injury	15.07 ± 10.67
Lesion level	
Paraplegic	29 (47.5%)
Quadriplegic	32 (52.5%)
Completeness of Injury	
Complete	25 (41%)
Incomplete	36 (59%)

Measures

Body image evaluation. The Adult Body Satisfaction Questionnaire (ABSQ; Reboussin et al., 2000; Appendix B) assessed body image evaluation. The ABSQ was considered ideal for measuring body image in people with SCI as it measured satisfaction with physical appearance and satisfaction with physical function. Participants rated satisfaction with the following items over the previous 4 weeks on a 7-point scale ranging from -3 (*very dissatisfied*) to +3 (*very satisfied*);

1) overall level of physical fitness, 2) muscle strength in legs, 3) level of endurance or stamina, 4) muscle tone, 5) level of energy, 6) physical ability to do what you want or need to do, 7) muscle strength in arms, 8) weight, 9) shape, and 10) overall physical appearance. Item 7 was added by Martin Ginis et al. (2003) to reflect the importance of upper body strength for people with SCI. The function subscale items (items 1-7) were averaged to create an overall satisfaction with physical function score, and items 8-10 (appearance subscale) were averaged for an overall satisfaction with physical appearance score. This measure has shown adequate internal consistency for both subscales within the SCI population ($\alpha > .83$; Martin Ginis et al.). The ABSQ has also shown evidence of construct validity in the SCI population as the function and appearance subscales demonstrated changes in response to an LTPA intervention (Hicks et al., 2003; Martin Ginis et al.). As LTPA is known to improve satisfaction with physical function and appearance (for a review, see Hausenblas & Fallon, 2006), these results suggest that the ABSQ is a valid measure of satisfaction with physical function and satisfaction with appearance for people with SCI. In the present thesis, the ABSQ showed adequate

internal consistency for both the function subscale ($\alpha = .83$) and the appearance subscale ($\alpha = .88$).

Leisure time physical activity. LTPA was measured using the *Physical Activity Recall Assessment for People with SCI* (PARA-SCI; Martin Ginis, Latimer, Hicks & Craven, 2005). The PARA-SCI is a self-report measure of all physical activities performed over a 3-day recall period. When completing the PARA-SCI, all physical activities were recorded (i.e., both LTPA and activities of daily living [ADL]). For the purpose of this thesis, only LTPA data, not ADL data, were analyzed. LTPA referred to any physical activity that an individual chose to do during his or her free time (Bouchard & Shephard, 1994). Each bout of LTPA was coded as either aerobic-LTPA or resistance-LTPA. Resistance-LTPA referred to activities such as strength training or lifting weights (see Appendix C). All activities that were not deemed resistance-LTPA were coded as aerobic-LTPA (i.e., wheeling, swimming, sports; see Appendix C). The participant then classified the intensity of each bout of activity as mild, moderate, or heavy intensity, or nothing at all, according to the PARA-SCI intensity classification system that describes physiological and psychological states associated with different intensities of activity (see Appendix C). The PARA-SCI measure of LTPA has demonstrated adequate construct validity (Latimer, Martin Ginis, Craven & Hicks, 2006), test-retest reliability, and criterion validity (Martin Ginis et al).

Total cumulative minutes of daily LTPA were calculated by summing the number of minutes reported for mild, moderate, and heavy intensity LTPA over the 3-day recall period and dividing the sum by 3 for a mean daily total. A mean daily amount of LTPA

for the 3-day recall period was also calculated for each intensity of LTPA (i.e., mild, moderate, heavy) by calculating a daily average of the number of minutes of LTPA reported for each respective intensity. Total minutes of resistance-LTPA was calculated by summing only bouts of LTPA that were coded as resistance-LTPA and taking a daily average for the 3-day period. Total minutes of aerobic-LTPA was also calculated by summing and averaging bouts of aerobic-LTPA.

Body composition

Weight. Weight was measured in kilograms using the Health O Meter's 2450KL™ (Pelstar LLC, Bridgeview, Illonois) portable wheelchair scale. The scale was calibrated using two 15-pound weights prior to each measurement session in order to ensure accuracy. Two measurements were taken to determine the weight of each participant: 1) wheelchair + participant, and 2) wheelchair only. The weight of each participant's wheelchair was then subtracted from his or her weight while seated in the wheelchair.

Waist circumference. While the participant was in a supine position with arms abducted at a 30° angle, waist circumference was measured at three anatomical sites: lowest rib, iliac crest, and mid-point between these sites. Measurements at these three sites have been pilot tested in four individuals with SCI and demonstrated high reproducibility (Edwards, Bugaresti, & Buchholz, 2007). The lowest rib and iliac crest are the easiest landmarks to palpate on individuals in the supine position. Measurements were taken following normal exhalation using the Gulick Anthropometric Tape™ (Sammons Preston, Bolingbrook, Illonois) designed for circumferential measurement during anthropometric examinations. Based on previous research in the SCI population (Edwards

et al., in press), the measurement taken at the lowest rib was used for this thesis. Waist circumference measured at the lowest rib is found to correlate more strongly with objective measures of visceral adipose tissue than waist circumference measured at the iliac crest or the midpoint between the lowest rib and the iliac crest (Edwards et al.). Although the current thesis is not interested in visceral adipose tissue per se, the measurement taken at the lowest rib may best capture the fattiest circumference of the waist for many individuals (i.e., most strongly related to visceral adipose) that may be related to body satisfaction.

Percentage body fat. Percentage of body fat was measured using whole-body bioelectrical impedance analysis (BIA). BIA has been shown to be a valid measure of percentage body fat in people with SCI (Buchholz, McGillivray & Pencharz, 2003). BIA is non-invasive, painless, and easy to use. Standard BIA protocol was followed using portable BIA equipment (BIA, RJL Systems Biolectrical Body Composition Analyzer Quantum II, Clinton Twp., MI). Before conducting BIA, the participant was asked to remove his or her right shoe and sock, as well as any jewelry. Assistance in removing shoes, socks, and jewelry was provided by the research assistant if necessary. The participant lay in supine position with arms and legs abducted at a 30° angle. Four electrodes were placed on the participant at the following anatomical locations: 1) first joint of right middle finger, 2) the posterior surface of the right wrist at the head of the ulna, 3) 1cm proximal to the first joint of the middle toes, and 4) anterior surface of the right ankle between the medial and lateral malleoli. The electrode sites were cleaned with alcohol. Cables that run from the BIA machine were then attached to the electrodes. The

BIA machine displayed a measure of *resistance* and *reactance*. The output from the BIA machine was then entered into the appropriate equations for calculating percentage of body fat (Chumlea et al., 2002; Appendix D).

The equations for calculating percentage of body fat require a measurement of stature (i.e., height). Therefore the height of each participant was measured using the Gulick Anthropometric Tape™ (Sammons Preston, Bolingbrook, Illonois). Height was measured while the participant was in supine position lying on a spinal board. The spinal board was used to obtain the most accurate measurement possible for this population while avoiding inaccurate measurement due to the concave nature of the body when lying on a soft surface such as a mattress. A research assistant held the participant's right leg in extension while dorsi flexing the right ankle in order to replicate the position of the lower leg while in a standing position. Full leg extension and dorsi flexion were attempted although was not always possible due to contractures and spasms of the legs while lying in supine position. The participant was asked to hold his or her head in a straight position during height measurement. Height was generally measured in two segements; 1) ankle to knee, and 2) knee to head. If the hip could not be placed in anatomical position (i.e., 0° angle hip extension) due to contractures, height was measured in three segments; 1) ankle to knee, 2) knee to hip, and 3) hip to head. The values of the two or three segments were then summed for a total height measurement to be used in the equations for calculating percentage of body fat.

Demographics. The following demographic characteristics were assessed through self-report; a) current age, b) age at time of injury, c) gender, d) level of injury, e) completeness of injury, and f) years post injury.

Procedure

The study design was cross-sectional. Trained research assistants followed a standardized telephone interview protocol for administering the PARA-SCI in order to measure self-reported LTPA. Each participant was randomized to a telephone interview date. Within 14 days of the telephone interview, two trained research assistants visited the home of the participant where body composition, body image evaluation and demographic information was collected. Prior to the home-based testing session, each participant was mailed an information letter with the following instructions for accurate BIA measurement; 1) refrain from food and drink, including alcohol and caffeine, for 12 hours prior to the test, 2) refrain from exercise and using a sauna for 8 hours prior to the test, 3) empty bladder 30 minutes prior to test (RJL systems, n.d.). Each participant was given a reminder telephone call on the evening prior to the home-based testing session to ensure that the instructions were followed for proper BIA measurement.

Upon arrival, the consent form was signed by the participant and research assistant. If the participant was unable to write independently, verbal consent was obtained and a research assistant signed on behalf of the participant. The participants' weight while sitting in the wheelchair was measured first. Participants were then assisted in transferring to their bed. Once lying on their bed, participants were transferred onto the spinal board in a supine position. Waist circumference and height measurements were taken from this

position. While the participants were on their bed, their wheelchair was weighed. All measures of body composition (i.e., weight, waist circumference, and BIA) were taken in duplicate. If there was a discrepancy greater than 5% between measures, a third measurement was taken. The results of the two or three measurements were then averaged. The ABSQ and participant demographic questions were read to the participant by the research assistant. Participants responded to the questions verbally as many participants were not able to write independently. Participants were given a hard copy of the ABSQ so that they could follow along with the research assistant. Upon completion of the home-based testing session, participants were thanked and given $10.00.

Results

Descriptive Statistics

Two men were unavailable to complete the PARA-SCI measure of LTPA. Further, research assistants were unable to obtain a waist circumference measurement for one male participant. Thus, the final male sample size fluctuates between n=48 to 50 across the analyses. The final female sample was n=11.

Tables 2 and 3 contain the means and standard deviations for body image evaluation and body composition variables respectively. Table 4 contains the descriptive statistics for each LTPA variable (i.e., total, heavy, moderate, mild, aerobic, and resistance). Also presented in Table 4, are the frequencies for each LTPA variable (e.g., percentage of participants who engage in *some LTPA* and *no LTPA*). In order to illustrate the distributions of the LTPA data, skewness and kurtosis statistics have been included in addition to histograms (Appendix E) for each LTPA variable. Skewness and kurtosis values of zero represent normally distributed data. Therefore, increasingly large positive and negative values indicated increasingly skewed or kurtotic data (Tabachnik & Fidell, 2001).

Independent-samples t-tests were calculated to compare men and women on each variable of body image evaluation, body composition and LTPA. T-tests indicated that there were significant differences between men and women for appearance satisfaction (Table 2; $p<.05$) and percentage body fat (Table 3; $p<.05$). There were no significant differences between men and women for any LTPA variable (Table 4). Given the sex

differences on the body image evaluation and body composition variables, sex was treated as an independent variable in the ANOVAs.

Table 2

Descriptive Statistics for Body Image Evaluation

	Men (n=50)		Women (n=11)	
	Mean	SD	Mean	SD
Functional Satisfaction	0.97	1.15	0.65	1.42
Appearance Satisfaction	0.97	1.68	-0.15*	1.63

Note. Possible score range: -3 (very dissatisfied) to +3(very satisfied).

* Between-groups comparison, $p<.05$

Table 3

Descriptive Statistics for Body Composition Variables

	Men			Women (n=11)		
	Mean	SD	Range	Mean	SD	Range
[a] Weight (kg)	77.72	13.67	50.30-122.30	71.76	21.26	45.00-114.40
[b] Waist Circumference (cm)	88.17	12.45	53.00-112.70	86.81	16.65	65.30-114.80
[a] Body Fat (% body mass)	25.39	7.68	4.43-38.67	34.19**	9.65	21.35-48.64

Note. [a] For men, n = 50

[b] For men, n = 49

**Between-groups comparison, $p<.01$

Table 4

Descriptive Statistics for Leisure Time Physical Activity

LTPA variable	Men (n= 48)						Women (n=11)					
			Frequency (%)						Frequency (%)			
	Mean (min)	SD	No LTPA	Some LTPA	Skewness	Kurtosis	Mean (min)	SD	No LTPA	Some LTPA	Skewness	Kurtosis
Total Cumulative LTPA	22.58	35.20	52	48	1.85	3.13	23.33	37.42	55	46	1.33	0.66
Heavy LTPA	2.72	8.89	88	13	4.10	18.48	0.91	3.02	91	9	3.32	11.00
Moderate LTPA	13.51	22.79	60	40	2.02	4.12	10.15	21.30	73	27	2.00	2.73
Mild LTPA	6.35	18.05	81	19	4.02	19.16	12.27	22.64	55	46	2.13	4.10
Aerobic LTPA	19.01	34.61	58	42	2.11	4.05	18.50	31.71	64	36	1.35	0.05
Resistance LTPA	3.58	9.33	81	19	2.94	8.12	4.85	8.50	73	27	1.33	-.09

Categorization of Leisure Time Physical Activity Data

Table 4 and Appendix H demonstrate the positive skewness of each LTPA variable. As recommended by Tabachnick and Fidell (2001), several transformations were calculated in an attempt to correct the skewed data prior to further analysis. The transformations were not successful in remedying the skewness of the data. Following the recommendations of Tabachnick and Fidell, the LTPA variables were dichotomized as *Some LTPA* and *No LTPA*. Heavy LTPA was removed from further analyses due to the low levels of participants who engaged in heavy LTPA.

Hypotheses Testing

Hypothesis 1a: Body composition will be negatively related to satisfaction with physical appearance such that higher body weight, percentage body fat, and waist circumference will be associated with lower levels of satisfaction with physical appearance.

For women only, significant correlations were found between appearance satisfaction and waist circumference (r = -.57, p<.05), as well as percentage body fat (r = -.55, p<.05; Table 5). None of the body composition variables were significantly related to appearance satisfaction among men. Therefore hypothesis 1a was partially supported as two measures of body composition were negatively related to satisfaction with physical appearance, but for women only.

Hypothesis 2a: Body composition will be negatively related to satisfaction with physical function such that higher body weight, percentage body fat, and waist circumference will be associated with lower levels of satisfaction with physical function.

Hypothesis 2a was not supported as none of the body composition variables were significantly correlated with functional satisfaction in men or women (Table 5).

Table 5

Bivariate Correlations Among Study Variables for Men and Women

	FUNC	APP	AGE	INJ	YPI	WT	CIRC	BF%
Functional Satisfaction (FUNC)	-	.67**	.08	-.10	.19	.22	.21	.08
Appearance Satisfaction (APP)	.50	-	.06	-.14	.20	.08	.21	.00
Current Age (AGE)	-.04	-.11	-	.56**	.54**	.27*	.29*	.07
Age At Injury (INJ)	-.62*	-.39	.53*	-	-.39**	.16	-.10	-.15
Years Post Injury (YPI)	.57*	.27	.55*	-.42	-	.14	.42**	.22
Weight (WT)	.27	-.33	.46	.38	.12	-	.68**	.44**
Waist Circumference (CIRC)	.16	-.57*	.43	.33	.13	.94**	-	.49**
Body Fat % (BF%)	-.01	-.55*	.33	.36	-.00	.67**	.74**	-

Note. Correlations for the male participants appear above the diagonal, while those for female participants appear below the diagonal.

* Correlation is significant at the .05 level (one-tailed).

** Correlation is significant at the .01 level (one-tailed).

Testing Hypotheses Regarding the Relationship between LTPA and Body Image Evaluation

Potential Covariates

Prior to testing the remaining hypotheses, it was necessary to determine which, if any, variables should be included as covariates in the analyses. Covariates within ANCOVA include those variables that are correlated with the dependent variable and are uncorrelated with any other covariate (Tabachnick & Fidell, 2001). As such, one-tailed Pearson's correlations were calculated to test continuous demographic variables and body composition variables as potential covariates of appearance satisfaction and functional satisfaction (see Table 5). ANOVAs were performed to test dichotomous variables (i.e., level and completeness of injury; see Table 6) as potential covariates of appearance and functional satisfaction. Pearson's correlations indicated that for women only there were significant correlations between functional satisfaction and years post injury (r= .57, p<.05), as well as age at the time of injury (r= -.62, p<.05). No other demographic variables were significantly correlated with functional satisfaction for men or women (Table 5). No demographic variables were significantly correlated with appearance satisfaction for men or women (Table 5). ANOVAs indicated that satisfaction with physical appearance did not differ as a function of injury level or completeness for men or women (Table 6). For men only, individuals with paraplegia were more satisfied with the physical function of their bodies than individuals with quadriplegia (p<.10). Satisfaction with physical function did not differ by injury completeness for men or women.

Table 6

Body Image by Injury Level and Completeness

	Appearance Satisfaction				Functional Satisfaction			
	Men		Women		Men		Women	
Injury Characteristic	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Completeness								
Complete	1.30	1.49	-0.67	1.53	1.16	1.07	0.60	1.58
Incomplete	0.74	1.78	-0.22	1.85	0.85	1.21	0.69	1.44
Level								
Quadriplegic	0.85	1.52	-0.33	1.81	0.69	1.16	0.47	1.78
Paraplegic	1.08	1.85	0.17	1.45	1.26*	1.09	0.96	0.46

Note. Between-groups comparison, * $p<.10$

Having identified years post injury, age at time of injury, level of injury, waist circumference, and percentage body fat as correlates of body image evaluation, further steps were taken to determine their appropriateness for inclusion as covariates in the hypothesis tests.

The assumption of homogeneity of regression was tested which states that the relationship between the covariate and body image evaluation is the same at all levels of the independent variable (i.e., for men and women; Tabachnick & Fiddell, 2001). The body composition and demographic variables violated the assumption of homogeneity of regression as the relationship between each variable (i.e., years post injury, age at time of injury, level of injury, waist circumference, percentage body fat) and body image evaluation differed for men and women. Therefore, no covariates were included in the following analyses.

Data Analysis Strategy

Separate 2 (sex) x 2 (LTPA) general linear model ANOVAs were conducted on functional satisfaction and appearance satisfaction. As previously discussed, a liberal α value of $p<.10$ was set because of the small number of female participants resulting in low power for analyses involving sex. In testing the assumptions of ANOVA, Levene's tests of homogeneity of variance were calculated. Nonsignificant Levene's tests indicated equal variances across sex and LTPA groups for all variables. Table 7 and Table 8 show the means and standard deviations for body image evaluation scores as a function of intensity and mode of LTPA. Table 9 shows the results of the ANOVAs.

Although ANOVAs are useful for determining whether a significant difference exists between groups, the level of significance gives no indication of the magnitude of any

differences. Therefore, effect sizes were calculated to determine the strength of any differences. Furthermore, calculating an effect size can assist in determining whether a meaningful difference exists between two groups in circumstances of low statistical power where statistical significance may not be reached. As such, effect sizes were calculated following each ANOVA, regardless of whether statistically significant differences were observed.

Table 7

Means and Standard Deviations for Satisfaction with Physical Appearance

	Men (n=48)		Women (n=11)	
	Mean	SD	Mean	SD
LTPA intensity				
Total				
Some	0.51	1.77	0.07	2.11
None	1.43	1.49	-0.33	1.28
Moderate				
Some	0.40	1.80	0.11	2.22
None	1.37	1.51	-0.25	1.53
Mild				
Some	0.44	2.00	0.07	2.11
None	1.11	1.62	-0.33	1.28
LTPA mode				
Aerobic				
Some	0.48	1.91	0.67	1.89
None	1.35	1.43	-0.62	1.39
Resistance				
Some	0.37	1.81	0.11	2.22
None	1.13	1.64	-0.25	1.53

Note. Possible scale range: -3 (very dissatisfied) to +3 (very satisfied)

Table 8

Means and Standard Deviations for Satisfaction with Physical Function

	Men (n=48)		Women (n=11)	
	Mean	SD	Mean	SD
LTPA Intensity				
Total				
Some	0.71	1.37	-0.40	1.43
None	1.19	0.92	1.52	0.62
Moderate				
Some	0.57	1.44	-0.14	1.55
None	1.22	0.90	0.95	1.36
Mild				
Some	0.67	1.62	-0.40	1.43
None	1.03	1.06	1.52	0.62
LTPA mode				
Aerobic				
Some	0.79	1.40	-0.04	1.36
None	1.08	0.99	1.04	1.40
Resistance				
Some	0.49	1.42	-0.14	1.55
None	1.07	1.10	0.95	1.36

Note. Possible scale range: -3 (very dissatisfied) to +3 (very satisfied).

Table 9

Results of ANOVAs Comparing Body Image Evaluation by Intensity and Mode of LTPA for Men and Women

	Appearance Satisfaction			Functional Satisfaction		
	F (*df*=1, 59)			F (*df*=1,59)		
LTPA Intensity	LTPA	Sex	Sex x LTPA	LTPA	Sex	Sex x LTPA
Total	0.22	3.98**	1.43	9.73***	1.00	3.55*
Moderate	0.25	2.48	1.12	3.91**	1.26	0.26
Mild	0.05	2.33	0.8	7.71***	0.48	3.60
LTPA Mode						
Resistance	0.09	1.60	0.75	3.22*	0.66	0.30
Aerobic	0.14	2.49	3.62*	2.64	1.07	0.88

Note. *$p<.10$, **$p<.05$, ***$p<.01$

Hypothesis 1b: After controlling for body composition, participants who engage in LTPA will have more satisfaction with physical appearance than participants who do not engage in LTPA.

Body composition was not controlled for during this analysis for reasons discussed under "Potential covariates." For satisfaction with physical appearance, significant main effects emerged for sex, F (1, 59) = 3.98, $p<.05$. Overall, men were more satisfied with their physical appearance than women. No significant main effects emerged for LTPA and there was no sex x LTPA interaction. Therefore hypothesis 1b was not supported.

Hypothesis 2b: After controlling for body composition, participants who engage in LTPA will have more satisfaction with physical function than participants who do not engage in LTPA.

Body composition was not controlled for during this analysis for reasons discussed under "Potential covariates." For satisfaction with physical function, significant main effects emerged for total LTPA, F (1, 59) = 9.73, $p<.01$. The main effects of total LTPA were superceded by a significant sex x total LTPA interaction, F (1, 59) = 3.55, $p<.10$. Bonferroni's post hoc analysis indicated that women who engaged in LTPA were less satisfied with their physical function than women who did not engage in LTPA. However, there was no difference in functional satisfaction between men who engaged in LTPA and men who did not.

Hypothesis 3a: Body image will be more strongly related to moderate intensity LTPA than mild intensity LTPA such that the difference in satisfaction with physical appearance between those who engage in moderate LTPA versus those who do not, will

be greater than the difference between those who engage in mild LTPA versus those who do not.

Body composition was not controlled for during these analyses for reasons discussed under "Potential covariates." There were no significant main effects for mild or moderate intensity LTPA on satisfaction with physical appearance. Effect sizes were calculated using the formula for Cohen's d (Cohen, 1992) to compare the effects of moderate versus mild LTPA (Table 10). For men, although the effect size for moderate LTPA (-.58) was larger than for mild LTPA (-.37), the effect sizes were negative indicating that men who engaged in moderate or mild LTPA were less satisfied with their physical appearance than men who did not. Therefore, hypothesis 3a was not supported for men.

For women, contrary to hypothesis, the effect sizes were quite similar for moderate (0.19) and mild LTPA (0.23). However, they were positive indicating that women who engaged in moderate or mild LTPA were more satisfied with their physical appearance than those who did not.

Hypothesis 3b: Body image will be more strongly related to moderate intensity LTPA than mild intensity LTPA such that the difference in satisfaction with physical function between those who engage in moderate LTPA versus those who do not, will be greater than the difference between those who engage in mild LTPA versus those who do not.

Body composition was not controlled for during these analyses for reasons discussed under "Potential covariates." Significant main effects emerged for moderate LTPA, $F(1, 59) = 3.91$, $p<.05$ and mild LTPA, $F(1, 59) = 7.71$, $p<.01$ on satisfaction with physical function. Effect sizes were calculated (Cohen, 1992) to compare the effects of moderate versus mild LTPA (Table 11). For both men and women, although the effect sizes for

moderate LTPA (men= -.51; women= -.75) were larger than the effects sizes for mild LTPA (men=-.26; women=-.17), the effect sizes were negative indicating that men and women who engaged in moderate or mild LTPA were less satisfied with the physical function of their bodies than those who did not. Therefore, hypothesis 3b was not supported for men or women.

Table 10

Effect Sizes for the Difference in Satisfaction with Physical Appearance for those who Engage in LTPA vs. those who do not

	Men (n=48)	Women (n=11)
	ES	ES
Intensity of LTPA		
Some vs. No Moderate LTPA	-0.58	0.19
Some vs. No Mild LTPA	-0.37	0.23
Mode of LTPA		
Some vs. No Aerobic LTPA	-0.52	0.78
Some vs. No Resistance LTPA	-0.44	0.19

Table 11

Effect Sizes for the Difference in Satisfaction with Physical Function for those who Engage in LTPA vs. those who do not

	Men (n=48)	Women (n=11)
	ES	ES
Intensity of LTPA		
Some vs. No Moderate LTPA	-0.51	-0.75
Some vs. No Mild LTPA	-0.26	-0.17
Mode of LTPA		
Some vs. No Aerobic LTPA	-0.24	-0.78
Some vs. No Resistance LTPA	-0.46	-0.75

Hypothesis 4a: Body image will be more strongly related to resistance-LTPA than aerobic-LTPA such that the difference in satisfaction with physical appearance between those who engage in resistance-LTPA versus those who do not, will be greater than the difference between those who engage in aerobic-LTPA versus those who do not.

Body composition was not controlled for during these analyses for reasons discussed under "Potential covariates." There were no significant main effects for aerobic or resistance LTPA on satisfaction with physical appearance. Although no significant effects emerged for sex, the sex x aerobic-LTPA interaction was significant F (1, 59) = 3.62, $p<.10$. Bonferroni's post hoc analysis indicated that women who did not engage in aerobic-LTPA were less satisfied with the physical appearance of their bodies than men who did not engage in aerobic-LTPA. No other comparisons were significant. Effect sizes were calculated using the formula for Cohen's d (Cohen, 1992; Table 10) to compare the effects of aerobic-LTPA versus resistance-LTPA. For men, the effect sizes for resistance-LTPA (-.44) and aerobic-LTPA (-.52) were negative indicating that men who engaged in resistance or aerobic-LTPA were less satisfied with their physical appearance than men who did not. Therefore, hypothesis 4a was not supported for men. For women, contrary to hypothesis, the effect size for aerobic-LTPA (.78) was larger than the effect size for resistance-LTPA (.19) indicating that aerobic-LTPA was more strongly related to satisfaction with physical appearance than resistance-LTPA.

Hypothesis 4b: Body image will be more strongly related to resistance-LTPA than aerobic-LTPA such that the difference in satisfaction with physical function between those who engage in resistance-LTPA versus those who do not, will be greater than the difference between those who engage in aerobic-LTPA versus those who do not.

For satisfaction with physical function, significant main effects emerged for resistance LTPA, F (1, 59) = 3.22, p<.10 indicating that participants who engaged in resistance-LTPA were less satisfied with their physical function than participants who did not. No significant effects emerged for sex or sex x LTPA. Effect sizes were calculated (Cohen, 1992) to compare the effect of resistance-LTPA versus aerobic-LTPA. For men and women, the effect sizes for resistance-LTPA (men=-.46; women=-.75) and aerobic-LTPA (men=-.24; women=-.78) were negative indicating that those who engaged in resistance-LTPA or aerobic-LTPA were less satisfied with their physical function than those who did not. Therefore, hypothesis 4b was not supported for men or women. Table 12 reviews the outcome of each hypothesis test.

Table 12

Results of Hypothesis Testing

Hypothesis	Result
1a	Partially Supported
1b	Not Supported
2a	Not Supported
2b	Not Supported
3a	Not Supported
3b	Not Supported
4a	Not Supported
4b	Not Supported

Discussion

This thesis explored the relationships between body composition, LTPA, and body image evaluation in people with SCI. The findings suggest that these relationships are complex. The following section will discuss the results as well as the theoretical and practical implications of the thesis.

Appearance body image evaluation

Appearance body image evaluation refers to people's satisfaction or dissatisfaction with the physical appearance of their bodies (i.e., weight, shape, overall appearance). The study sample was generally satisfied with the physical appearance of their bodies suggesting that body image disturbance may not have been an issue for many of the participants. Women were less satisfied with the physical appearance of their bodies than men, as is typical in the general population (e.g., Smith et al., 1999).

Given the negative changes in body composition and LTPA that generally follow SCI, the absence of negative body image evaluation within the sample is incongruent with Cash's (2002) model. There are two possible explanations for this unexpected finding. First, Cash proposes that appearance body image evaluation develops based on a goodness-of-fit model (Lerner & Jovanovic, 1990). That is, satisfaction with physical appearance is a function of the discrepancy between people's actual or perceived body composition and their internalized standards for their body composition. Following SCI, individuals may lower the standards and ideals for their bodies by shifting value away from their physical qualities (Wright, 1983). In addition, some people with SCI may no longer identify with the current societal standards of a thin physique for women (Striegel-Moore & Franko, 2002), or a lean and muscular physique for men (Pope et al., 1999). As such, the discrepancy between their standards and their actual physical composition

(i.e., goodness-of-fit; Lerner & Jovanovic) may be minimized such that body image disturbance does not arise. Second, the many other fundamental changes that follow SCI (e.g., change in employment opportunities and independence) may take precedence over the importance of changes to the physical appearance of the body. Although individuals may perceive themselves to be less physically attractive than prior to their disability (e.g., Kettl et al., 1990; Taleporos & McCabe, 2001), the level of investment (Cash) in body image evaluation may diminish following SCI. As such, appearance satisfaction may be of little importance following SCI, and thus individuals with SCI may be less likely to report dissatisfaction with physical appearance.

Appearance body image evaluation and body composition. Body composition was negatively correlated with satisfaction with physical appearance for women only. The relationship between body composition and body image evaluation has not been previously explored in the SCI population. Research in the general population has largely focused on this relationship in women only (e.g., Davis et al., 1994) and has shown that objective measures of body composition may be more important for women than men in determining satisfaction with physical appearance. For example, there was an association between objective measures of body composition and changes in body image for able-bodied women, but not men participating in an exercise study (Martin Ginis et al., 2005). Men may place more importance on the physical capabilities of their bodies, such as level of strength or endurance, than the physical composition of their bodies when developing their body image evaluation (Martin Ginis et al.), which may explain the null relationship between body composition and appearance body image evaluation for the men in the current thesis.

For women, waist circumference and percentage body fat, but not weight, were negatively related to appearance satisfaction. There are two possible explanations for the nonsignificant

relationship between weight and appearance satisfaction. First, unlike waist circumference and percentage body fat, weight is not necessarily associated with being visibly fatter. That is, women with a larger waist circumference or a higher percentage body fat are likely to appear larger or fatter than women with a smaller waist circumference or lower percentage body fat. In contrast, a muscular woman may appear lean and toned, yet weigh more than a woman who appears flabby and untoned. Accordingly, women with larger or fatter appearances are likely to have a greater discrepancy between their actual body composition and their internalized standards, and therefore have greater dissatisfaction with their physical appearance, than smaller or thinner women. Women of a higher body weight may not necessarily appear larger or fatter than women of a lower body weight. Consequently, body weight may not be related to appearance satisfaction for women. A second explanation for the nonsignificant relationship between body weight and appearance satisfaction may be related to low statistical power. Body weight may have been significantly related to appearance satisfaction in a larger sample of women.

Appearance body image evaluation and leisure time physical activity. Satisfaction with physical appearance did not significantly differ between participants who engaged in LTPA and those who did not. This finding is not congruent with Cash's (2002) model which suggests that self-regulatory behaviours, such as LTPA, are related to body image evaluation. However, for female participants, there was a nonsignificant trend toward higher levels of body satisfaction among those who engaged in LTPA compared to those who did not. With greater statistical power, this trend may have emerged as statistically significant.

The trend supports Cash's model and is consistent with previous research in the general population suggesting that people who engage in LTPA have greater body satisfaction than

people who do not (Hausenblas & Fallon, 2006). Similarly, people with SCI reported improved body satisfaction following a LTPA intervention (Martin Ginis et al., 2003). Women who engage in LTPA may have greater body image evaluation through increased self-efficacy and increased awareness of physical capabilities (Martin & Lichtenberger, 2002). Additionally, women who engage in LTPA may perceive themselves to have better body composition than women who do not engage in LTPA. That is, body composition may mediate the relationship between LTPA and satisfaction with physical appearance for women (Martin & Lichtenberger). The trend toward a positive relationship between LTPA and appearance satisfaction in the current thesis, in addition to the findings of previous literature, suggest that there may be a positive relationship between LTPA and appearance satisfaction in women with SCI.

For male participants, there was a nonsignificant trend toward lower levels of satisfaction with physical appearance among men who engaged in LTPA compared to those who did not. This finding was surprising considering that men with SCI, who participated in a randomized controlled trial, reported improved satisfaction with physical appearance following a LTPA intervention (Hicks et al., 2003; Martin Ginis et al., 2003). Dissatisfaction with physical appearance may motivate some men to engage in LTPA in an attempt to change their body composition (Davis & Cowles, 1991). The relationship between LTPA and appearance satisfaction for men with SCI, may depend on several moderator variables such as the level of investment in appearance satisfaction (i.e., level of importance), or appearance satisfaction prior to SCI. Other variables have been found to moderate the relationship between LTPA and body image such as age, LTPA mode, and LTPA intensity (Hausenblas & Fallon, 2006). Further research is needed to determine the factors that moderate the LTPA-appearance satisfaction relationship in men with SCI.

Appearance body image evaluation and intensity of leisure time physical activity. There was no difference in satisfaction with physical appearance for people who engaged in moderate or mild intensity LTPA compared to those who did not. For female participants, the effect sizes for mild and moderate LTPA were of a small magnitude and in a positive direction. For male participants, the effect sizes for mild and moderate LTPA were of a medium magnitude and in a negative direction. Because heavy intensity LTPA was removed from the analyses due to low levels of participation, it was not possible to compare the difference in satisfaction with physical appearance between those who engaged in heavy LTPA and those who did not. It is unfortunate that this analysis was not possible as heavy LTPA is likely to result in the positive body composition changes that may explain previous research demonstrating higher levels of satisfaction with physical appearance in people who engage in LTPA compared to people who do not (e.g., Hausenblas & Fallon, 2006). Moderate intensity LTPA, as reported by participants in the current thesis, may not have been of sufficient frequency or duration to promote changes in body composition which can lead to higher levels of satisfaction with physical appearance.

Appearance body image evaluation and mode of leisure time physical activity. There was no difference in appearance satisfaction for people who participated in either resistance-LTPA or aerobic-LTPA compared to those who did not. However, women who engaged in aerobic-LTPA had significantly higher satisfaction with physical appearance than men who engaged in aerobic-LTPA. This difference probably reflects a difference in the perceived ideal body compositions for women and men. Women who had a smaller waist circumference and lower percentage body fat were more satisfied with their physical appearance than women who had a larger waist circumference and higher percentage body fat. Aerobic-LTPA can cause changes in body composition such as decreased waist circumference and body fat percentage. These changes are

more important for women than men in the development of appearance body image evaluation (Martin Ginis et al., 2005). As such, it is plausible that women who engage in aerobic-LTPA perceive themselves to have a more ideal body composition, whereas men who engage in aerobic-LTPA may not, given that aerobic-LTPA is unlikely to cause changes in body composition that are considered ideal for men (e.g., lean and muscular physique, "bulging biceps", "six-pack abs"). In line with this reasoning, men who had a smaller waist circumference, lower body weight, or lower percentage body fat were not more satisfied with their physical appearance. Taken together, these findings highlight the role of sex and mode of LTPA as moderators for the relationship between LTPA and body image evaluation in people with SCI.

Functional body image evaluation

Functional body image evaluation refers to people's satisfaction or dissatisfaction with the physical function of their bodies (e.g., arm strength, physical ability to do what they want or need to do, muscle tone). Both men and women were generally satisfied with the physical function of their bodies. This finding was surprising considering the functional limitations that follow SCI. For example, many individuals within the sample were unable to write independently, transfer themselves to and from their wheelchair, or remove their own socks and shoes during the home-based testing session, and yet they did not report dissatisfaction with the physical function of their bodies. Similar to changes in ideals and standards for the appearance of their bodies, people may lower their ambitions and expectations for the function of their bodies following SCI. As such, they may not feel dissatisfied because their expectations have been lowered and they have accepted the functional limitations of SCI.

Functional body image evaluation and body composition. There has been no previous research to examine the relationship between body composition and satisfaction with physical

function in the SCI population. As has been shown in other populations (e.g., Reboussin et al., 2000), one would expect that healthier levels of body composition would lead to greater satisfaction with physical functioning resulting from increased ease with actually performing physical tasks. Contrary to hypothesis, body composition was not significantly related to functional satisfaction for men or women. One explanation for this finding is that the actual impact of the disability on physical function may override the importance of body composition in developing satisfaction with physical function. It has been suggested that the *impact* of the disability is a fundamental factor for consideration when examining body image in people with acquired disabilities such as SCI (Rybaraczyk & Behel, 2002). SCI is a very heterogeneous disability and thus the impact of the disability on physical function can vary tremendously between individuals despite the level and completeness of the injury. Further, an individual's skill acquisition for functioning following SCI may be more important in the development of satisfaction with physical function than body composition (Stewart et al., 2000). For example, acquiring the necessary skills to transfer, dress, and bathe independently may be more influential in the development of functional satisfaction following SCI than measures of body composition such as waist circumference, weight, and body composition.

Functional body image evaluation and leisure time physical activity. Contrary to hypothesis, people who engaged in LTPA were less satisfied with the physical function of their bodies than people who did not engage in LTPA. This finding was surprising as LTPA has been shown to improve satisfaction with physical function in people with SCI (Hicks et al., 2003; Martin Ginis et al., 2003). However, individuals who have poor levels of body satisfaction may be motivated to engage in LTPA in an attempt to improve their physical functioning (Heinberg et al., 2001).

Women who engaged in LTPA had poorer functional body image evaluation than men who engaged in LTPA. This is likely a reflection of the sex differences in satisfaction with physical function --women may be generally less satisfied with their bodies than men (Davis & Cowles, 1991) despite LTPA participation. Although there was no main effect for sex on satisfaction with physical function, the mean level of satisfaction with the physical function was lower for women than men (nonsignificant) and there may have been a significant main effect of sex with a larger sample of women.

Functional body image evaluation and intensity of leisure time physical activity. People who engaged in moderate or mild LTPA had poorer functional body image evaluation than people who did not. These findings are consistent with the explanation that individuals who are dissatisfied with the physical function of their bodies are motivated to engage in LTPA at a moderate or mild intensity level. The effect sizes for the difference in satisfaction with physical function between people who engaged in moderate LTPA and those who did not, were larger than the effect sizes for the difference in satisfaction with physical function for those who engaged in mild LTPA and those who did not. These differences may suggest that those who are less satisfied with the physical function of their bodies may be more motivated to engage in higher intensity LTPA (i.e., moderate) compared to those who are more satisfied. Unfortunately, heavy LTPA could not be evaluated in relation to satisfaction with physical function as so few participants reported heavy LTPA.

Functional body image evaluation and mode of leisure time physical activity. There was no significant difference in satisfaction with physical function between those who engaged in aerobic-LTPA and those who did not. However, participants who engaged in resistance-LTPA had poorer functional body image evaluation than participants who did not. People with SCI may

consider physical strength to be important for improving physical function. As such, those who are less satisfied with the physical function of their bodies may be motivated to engage in resistance-LTPA in order to improve their physical strength and ultimately, their physical functioning.

For men in particular, dissatisfaction with physical function may be a motivating factor for engaging in resistance-LTPA. For some men with SCI, dissatisfaction with physical function may reflect dissatisfaction with physical strength. As discussed previously, men may place more importance on the physical capabilities of their bodies, such as level of strength (Martin Ginis et al., 2005), and therefore choose to engage in resistance training. In line with this reasoning, the negative effect size for the difference in satisfaction with physical function between men who engaged in resistance-LTPA and those who did not, was larger than the negative effect size for the difference in satisfaction with physical function between men who engaged in aerobic-LTPA and those who did not. In contrast, for women, there were large negative effect sizes for the difference in functional satisfaction between those who engaged in resistance or aerobic-LTPA and those who did not. This finding suggests that women with SCI who are less satisfied with the physical functioning of their bodies may be more motivated to engage in both aerobic-LTPA and resistance-LTPA than women who are more satisfied with their physical functioning.

Theoretical implications

We are unaware of any other theory-driven research that has examined the relationship between body image and LTPA in individuals with SCI. The results of this thesis provide important directions for the future use of Cash's (2002) cognitive-behavioural model of body image within the SCI population. Specifically, the following paragraphs will explain how the current thesis has contributed to our understanding of the directionality of the relationship

between the constructs of Cash's model. In addition, this section will discuss special considerations for using Cash's model in populations with disease or disability, such as the SCI population.

Directionality of the relationship between the constructs of Cash's model. Cash (2002) states that he intentionally did not include directional arrows between the constructs of his model (see Figure 1) due to the complexity of determining causal relationships within body image research. The majority of the physical activity and body image literature in the general population has found that people who engage in LTPA have more positive body image evaluation than people who do not engage in LTPA (Hausenblas & Fallon, 2006) and would suggest that LTPA causes improvements in body image evaluation. These findings have been replicated in experiments examining the effects of LTPA on body image in the SCI population (e.g., Hicks et al., 2003; Martin Ginis et al., 2003; Yeun & Hanson, 2002).

However, the findings of the current thesis suggest that the relationship between LTPA and body image evaluation for people with SCI may not be a simple positive relationship. Many people who engaged in any intensity or mode of LTPA had poorer appearance satisfaction and functional satisfaction than people who did not. This finding has been explained by the possible motivation for LTPA that develops from dissatisfaction with physical appearance or physical function. Previous research has shown that body image concerns or body image disturbance may prompt individuals to engage in behaviours such as LTPA (Heinberg et al., 2001). Cash himself explains that individuals may use self-regulatory behaviours such as LTPA to minimize negative body image evaluation. With Cash's explanation in mind, it seems plausible that individuals with low body satisfaction would engage in higher levels of LTPA in order to minimize or cope with negative body image evaluation. This possibility is supported by the present findings.

Nevertheless, due to the cross-sectional design of the current thesis, we are unable to establish any causal relationship between body image evaluation and LTPA. Future research, particularly in the SCI population, should consider the possibility that poor body image evaluation leads to participation in LTPA.

Prospective studies should be conducted within the framework of Cash's model, to further contribute to understanding the directionality of the relationship between body image evaluation and LTPA. This relationship may in fact be bidirectional. That is, body dissatisfaction may be a motivating factor for engaging in LTPA. In turn, LTPA may result in improved body satisfaction through positive changes in body composition, or other potential mediators such as increased self-efficacy or increased awareness of physical capabilities (Martin & Lichtenberger, 2002). Figure 2 shows a modification of Cash's model that takes into account the possible bidirectionality of the relationship between LTPA and body image evaluation, and possible mediators.

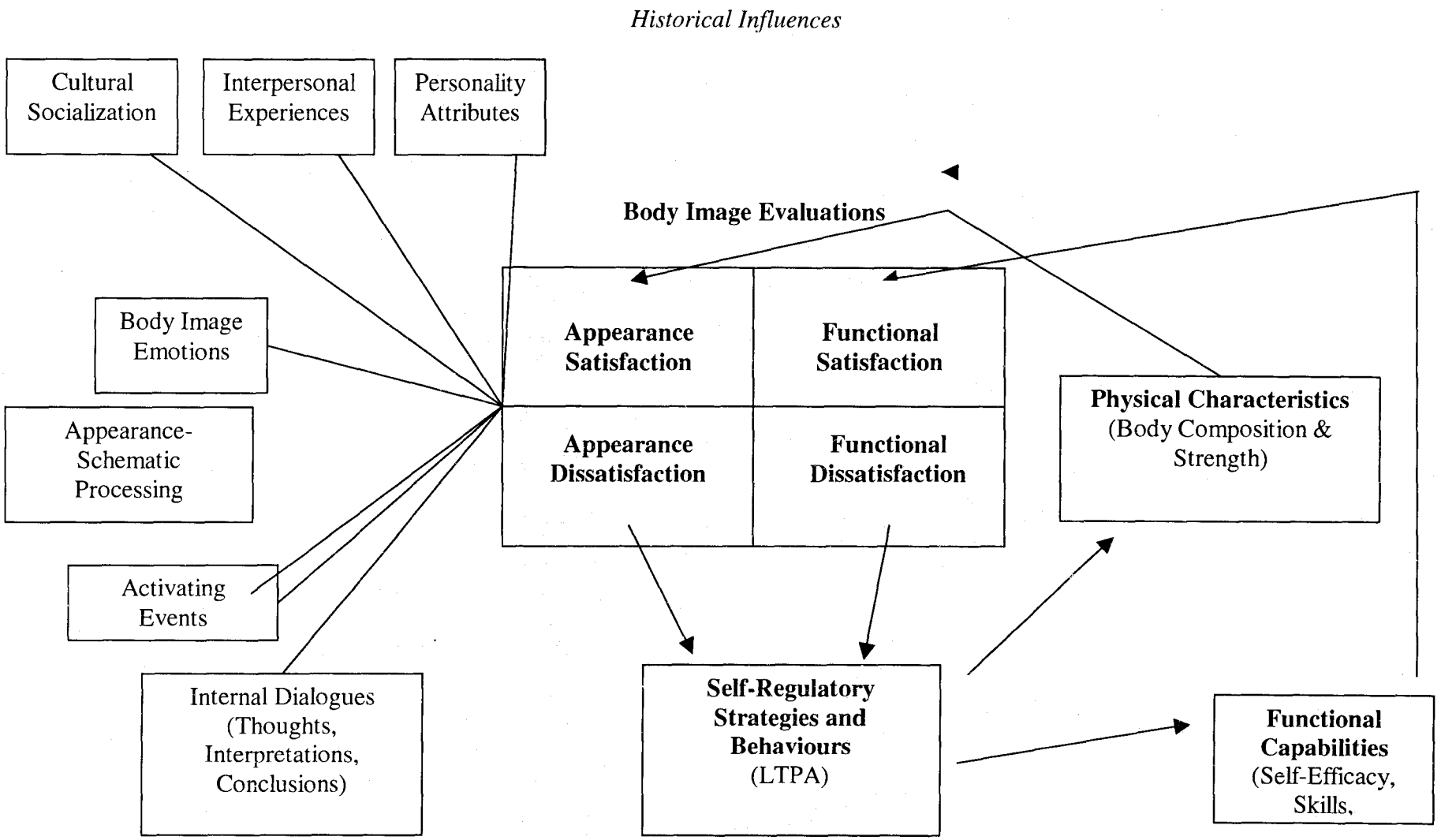
Historical Influences
Cultural Socialization
Interpersonal Experiences
Personality Attributes
Body Image Evaluations
Body Image Emotions
Appearance-Schematic Processing
Activating Events
Internal Dialogues (Thoughts, Interpretations, Conclusions)
Appearance Satisfaction
Functional Satisfaction
Appearance Dissatisfaction
Functional Dissatisfaction
Physical Characteristics (Body Composition & Strength)
Self-Regulatory Strategies and Behaviours (LTPA)
Functional Capabilities (Self-Efficacy, Skills,
Proximal Processes

Figure 2. Modification of Cash's (2002) Cognitive-Behavioural Model of Body Image.

Recommendations for using Cash's model. The current thesis represents the first known use of Cash's (2002) model for studying body image within the SCI population. The results of the thesis have highlighted some important recommendations for future theory-driven research using Cash's model.

The first recommendation is that satisfaction with physical function and satisfaction with physical appearance be considered separately. Our data showed that the relationship between the constructs of Cash's (2002) model (i.e., LTPA, body composition, body image evaluation) varied depending on whether the analysis involved functional satisfaction or appearance satisfaction. For example, among women, a negative correlation was found between body composition and appearance satisfaction, but not functional satisfaction. Satisfaction with physical appearance and physical function are two independent aspects of body satisfaction within other populations as well (Reboussin et al., 2000). Failure to consider functional satisfaction and appearance satisfaction separately within Cash's model will limit our understanding of the relationships between the constructs of the model. Moreover, future research to examine mediators and moderators of the relationships will be restricted without separate analysis of appearance and function satisfaction, as these are likely to differ between the two constructs. Figure 2 demonstrates one possibility for modifying Cash's model to examine satisfaction with physical function and satisfaction with physical appearance separately.

A second recommendation for using Cash's (2002) model is that data from men and women should be analyzed separately. Our data showed differences between men and women in the relationships between body image evaluation, body composition and LTPA. For example, women who engaged in mild or moderate LTPA had greater appearance satisfaction than women who did not, whereas men who engaged in mild or moderate LTPA had poorer appearance

satisfaction than men who did not. Previous research has also shown sex differences when examining the relationship between body image evaluation, LTPA and body composition (e.g., Martin Ginis et al., 2005). Because sex may moderate the relationships between the constructs of Cash's model, it is important that men and women be considered independently when using the model to examine body image evaluation.

A final recommendation is that the impact of disability on physical functioning should be considered. Contrary to hypothesis, our data showed no relationship between body composition and satisfaction with physical function. This was surprising because a negative relationship between the constructs has been found in other populations (Reboussin et al., 2000). For people with SCI, the impact of body composition on functional satisfaction may be overridden by the actual impact of the disability on physical functioning. For example, having a high percentage of body fat or a large waist circumference may not impact individuals' abilities to do what they want or need to do, if they do not have sufficient preservation of motor functioning to perform certain tasks anyway. Additionally, contrary to hypothesis, people who engaged in LTPA were less satisfied with the physical function of their bodies than those who did not. Again, the impact of LTPA on functional satisfaction may be overridden by the actual impact of the disability on physical functioning. For instance, no matter how much LTPA individuals engage in, their disability may limit them from doing things that are important in the development of functional satisfaction (e.g., dressing, bathing, feeding independently). Therefore, when using Cash's (2002) model to examine functional body image evaluation in people with SCI, the impact of disability on physical functioning should be considered as a moderator.

Future research should also consider other psychological factors that may be related to body image evaluation. For individuals with SCI, symptoms of depression may be particularly

important to consider when studying body image evaluation as the SCI population experiences a higher prevalence of depression than the general population (Kennedy & Rogers, 2000). The relationship between body image evaluation and depression has been explored in previous research. On the one hand, depression may increase the risk for body dissatisfaction as depressed affect may bias individuals' perceptions of their bodies (Stice & Whitenton, 2002). On the other hand, body dissatisfaction may lead to depressive symptoms (Stice & Whitenton). Future research should explore depression and other psychological factors in relation to body image evaluation.

The recommendations drawn from the current thesis should be potentially integrated into Cash's model for future research in the SCI population. The development of a SCI-specific theoretical framework may be of benefit for examining the relationships between body image evaluation, LTPA and body composition in people with SCI.

Limitations

The cross-sectional design of the thesis is a limitation for interpretation of the results, as directionality or causation cannot be established. Although evidence-based explanations for the relationship between LTPA and body image evaluation have been presented, it is impossible to determine any causal role between the variables. Prospective research is needed to understand the issue of directionality between LTPA and body image evaluation. Future research should also explore different modes and intensities of LTPA as moderators of the relationship between LTPA and body image evaluation. Moreover, prospectively designed studies are required to examine changes in body composition as a mediator of the relationship between LTPA and body image evaluation.

A second limitation that bears mentioning is the small number of female participants in the sample and the limited variance of the study measures within the female sample. Although the sample is representative of the overall SCI population (i.e., approximately 80% male; CPA, 2007), the limited number of women requires cautious interpretation of the observed sex differences. Ideally, future research in this area would employ a larger overall sample that could maintain the characteristics of the SCI population while including a larger number of female participants. A larger sample of female participants may also increase the variance within the study variables. An increase in variance may result in different findings regarding the relationships between study variables than those found for women in the current study. This may be of particular importance when examining potential covariates of body image evaluation.

Results regarding body composition and body image evaluation should also be interpreted with some caution. Specifically, the use of bioelectrical impedance analysis (BIA) to measure percentage body fat is not recommended for single measurements in individual participants (Buchholz, Bartok, & Schoeller, 2004). Although percentage fat mass has been predicted reasonably well in a group of individuals with paraplegia (Buchholz, et al., 2003), it is generally recommended that BIA be used to measure body composition at the group level only (Buccholz et al., 2004). The relationship between percentage body fat and appearance satisfaction for women in the current thesis was in the expected direction which may suggest that percentage body fat was reasonably well predicted by the use of BIA.

A final limitation that warrants consideration is the face-to-face, verbal assessment of body image evaluation. Questionnaires completed in this fashion may underestimate the prevalence of body dissatisfaction because shame and discomfort associated with conversationally expressing body dissatisfaction may make participants hesitant to disclose their true concerns (Pruzinsky,

2003). We chose this method of measurement because many of the participants were unable to write independently. As such, this limitation is difficult to avoid when measuring body image evaluation in the SCI population. Future research could consider measurement through telephone interview to avoid the discomfort that may be associated with face-to-face measurement of body image evaluation.

Practical implications

Very little research has been conducted on body image evaluation in the SCI population. What research that does exist has been confounded by limitations such as small sample sizes, lack of a theoretical framework, and inclusion of people with multiple disabilities in a single study (e.g., SCI, multiple sclerosis, lower limb amputation). As such, it has been difficult to consider the practical implications of previous research in the area. Despite the above-mentioned limitations, there are practical implications that warrant discussion. The following section will consider the practical implications of the current thesis for people with SCI.

Motivating people with SCI to engage in leisure time physical activity. Following SCI, people may modify their standards and expectations for their physical appearance and physical function (Wright, 1983). For many people with SCI, these changes in standards and expectations may reduce dissatisfaction with their physical appearance and physical function and minimize the risk of body image disturbance. Further support for the notion of changed standards following SCI, comes from research showing that women with physical disabilities worry less about small changes in their weight and shape than women without physical disabilities (Ben-Tovim & Walker, 1995). In line with this reasoning, the participants in this thesis were generally satisfied with the physical function and physical appearance of their bodies. On the one hand, a lack of body dissatisfaction could be considered a positive finding with regards to the physical and

psychological health of people with SCI. On the other hand, body dissatisfaction could be a key motivating factor for people to engage in LTPA (Heinberg et al., 2001). A lack of dissatisfaction (or perhaps concern) with body image evaluation, may partially explain the dismal rates of LTPA participation in the SCI population.

Of course we are not suggesting that negative body image evaluation be evoked within the SCI population for the purpose of motivating LTPA. However, for people who are already satisfied with their physical function and appearance, we need to make them aware of the many other health benefits of LTPA such as decreased risk for secondary complications (e.g., diabetes mellitus, cardiovascular disease, spasticity, pressure sores; Heath & Fentem, 1997; Kocina, 1997), and improved psychological well-being (e.g., decreased depression, chronic pain, stress; Hicks et al., 2003). The knowledge of these benefits may be instrumental in motivating individuals with SCI to engage in LTPA. Health professionals in the SCI community should emphasize the many benefits of LTPA for people with SCI and encourage participation in LTPA for improved physical and psychological health.

People with SCI may also resign themselves to their current physical appearance and level of physical functioning. As such, participation in LTPA may seem pointless. This reasoning is incorrect as people who engage in LTPA following SCI stand to improve their satisfaction with physical functioning and physical appearance. LTPA is positively related to aerobic fitness in people with SCI (Janssen et al., 1996; Latimer et al., 2006), which in turn is positively related to ease of performing physical tasks such as transferring, bathing, ascending curbs (Janssen et al.), and wheelchair skills (Duran et al., 2001). LTPA can also improve physical strength for people with SCI (Duran et al; Hicks et al., 2003). It is not surprising that changes in physical functioning are accompanied by improved levels of functional satisfaction following LTPA (e.g., Hicks et

al., 2003). Likewise, participants report improved satisfaction with physical appearance following SCI (e.g., Martin Ginis et al., 2003). These findings suggest that we must inform individuals of the possible gain in function and appearance that can result from LTPA following SCI, as this information may provide motivation for LTPA.

Intensity and duration of leisure time physical activity to improve body image evaluation? Previous research in the SCI population has found improved body image evaluation following a structured LTPA program (e.g., Hicks et al., 2003; Martin Ginis et al., 2003). The design of the current thesis does not allow for an understanding of the effects of LTPA on body image evaluation per se. Moreover, if positive change to body composition is the mechanism through which LTPA is positively related to body image evaluation, as found in previous research, it is possible that the participants in the current thesis were not engaging in LTPA long enough or intense enough to see positive changes in body composition. As such, LTPA at a higher intensity or longer duration, than performed by the participants in this thesis, may be necessary to see a positive relationship between LTPA and body image evaluation. Prospective research should explore the relationship between body image evaluation and LTPA performed at various intensities and durations.

Conclusion

The results of this thesis suggest that the relationship between body image, body composition and LTPA is not necessarily a simple one. First, the relations between body composition and body satisfaction varied for men and women. Women who had a smaller waist circumference or lower percentage body fat were more satisfied with their physical appearance than women with a larger waist circumference or higher percentage fat. For men, no relationship between body composition and appearance satisfaction was found. Second, the hypotheses regarding LTPA and

body satisfaction were generally unsupported as higher levels of LTPA were reported by individuals with lower levels of body satisfaction.

From a practical standpoint, the results suggest that dissatisfaction with physical appearance or physical function may motivate individuals with SCI to engage in LTPA. The many physical and psychological benefits of LTPA need to be emphasized to motivate individuals who are not dissatisfied with their physical appearance or physical function. However, future research needs to determine the causal relationship between LTPA and body image, and examine the possible bidirectionality of the relationship. Furthermore, prospective research is necessary to explore possible mediators and moderators of the relationship including body composition and sex respectively.

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Appendix A

Participant Letter of Information

LETTER OF INFORMATION

DETERMINING THE HEALTH BENEFITS OF PHYSICAL ACTIVITY AMONG INDIVIDUALS WITH SPINAL CORD INJURIES

Version I

You are being invited to participate in a research study lead by Dr. Kathleen Martin Ginis from the Department of Kinesiology at McMaster University. The Canadian Institute of Health Research sponsors this study.

If you have any questions or concerns about the research, please feel free to contact the project coordinator, Jen Vording at (905) 525-9140 x27937 or Kathleen Martin Ginis (905) 525-9140 x23754.

PURPOSE OF THE STUDY

The purpose of this study is to examine the relationships between physical activity and the risk of chronic disease among individuals living with a spinal cord injury. This is an ancillary study to the larger study in which you have already consented to be a part of. Further consent, specific to this ancillary study, is required for participation.

PROCEDURES

Chronic Disease Risk Factor Testing

If you volunteer to participate in this study, you will be asked to take part in 3 testing sessions in which a trained research assistant will come to your home and perform a series of tests that will identify if you are at risk of developing a chronic disease such as coronary artery disease or diabetes. Each session will last approximately one hour, and will consist of a standard blood pressure measurement, weight & height measurement, routine blood sampling, a recall of your diet for the past 3 days, and a questionnaire about body satisfaction. In addition, a measurement of percentage body fat will be taken using a simple, non-invasive technique known as bioelectrical impedance analysis. This involves the placement of 4 electrodes, 2 on your right hand, and 2 on your right foot, through which a small electric signal can be circulated. Bioelectrical impedance measures the resistance to the signal as it travels through the water that is found in muscle and fat. Testing sessions will be scheduled at your convenience in accordance with the testing time-line: baseline (0-weeks), 6 months, and 18 months. Each testing session will take approximately 1 hour and the total duration of this study is 18 months.

Accessing Study Findings

At the completion of the study, you will have access to the study's findings. Each year you will receive a newsletter outlining the results of the investigation. In addition, a web site will be created displaying the general findings of the study.

POTENTIAL RISKS AND DISCOMFORTS

The insertion of a needle for blood sampling is a common medical practice and involves few risks if proper precautions are taken. The needle is inserted under completely sterile conditions; however, there is a theoretical risk of infection. There is also a chance of internal bleeding if adequate pressure is not maintained upon removal of the needle. This may cause some minor discomfort and could result in bruising/skin discoloration, which could last for up to a few weeks. In very rare occasions, trauma to the vessel wall could result in the formation of a small blood clot, which could travel through the bloodstream and become lodged in a smaller vessel. As well, you may find the blood pressure cuff to be slightly uncomfortable when inflated.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

There are no direct benefits from participating in the project; however, there may be indirect benefits. For example, undergoing a battery of tests to determine the incidence of secondary impairments and the risk of chronic disease may alert you to health concerns that you may not have know about otherwise. At the end of the study, we will give you a report with your personal results from the various tests.

The information generated by this project will be used to develop guidelines for promoting physical activity among the spinal cord injured population and to develop exercise prescriptions that will alleviate the risk of secondary health complications. These outcomes have important implications for improving health and quality of life among people living with spinal cord injuries.

PAYMENT FOR PARTICIPATION

You will be paid $10 per visit for each of the 3 chronic disease risk factor testing sessions.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Any information obtained during the testing is completely private and will be kept in a locked filing cabinet in Martin Ginis' research laboratory for 5 years. Access to this information will be granted to the researchers and research assistants only. Your identity will never be revealed in any reports regarding this study. After 5 years, paper documents will be destroyed.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to undergo any of the tests and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so. Any data collected prior to withdrawal will be destroyed and not used for research purposes upon your request.

RIGHTS OF RESEARCH PARTICIPANTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through the Hamilton Health Sciences Research Board. If you have questions regarding your rights as a research participant, you may contact the Hamilton Health Sciences Patient Relations Specialist at (905) 522-1155, Ext. 3537.

SIGNATURE OF RESEARCH PARTICIPANT

I have been told about the information provided for the study "Determining the health benefits of physical activity among individuals living with spinal cord injury" as described herein. My questions have been answered to my satisfaction, and I agree to participate in this study. I will be given a signed copy of this information sheet and consent form. If I have any questions or concerns about this research, I can contact the project coordinator, Jen Vording at (905) 525-9140 x27937 or Dr. Kathleen Martin Ginis (905) 525-4140 x23754.

_____ _____

Name of Participant Date

_____

Signature of Participant

SIGNATURE OF INVESTIGATOR

In my judgment, the participant is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to participate in this research study.

_____ _____

Signature of Investigator Date

Appendix B

Adult Body Satisfaction Questionnaire

ADULT BODY SATISFACTION QUESTIONNAIRE

Please read each of the statements below. For each statement, indicate your level of satisfaction according to the following scale:

-3 = Very Dissatisfied
-2 = Somewhat Dissatisfied
-1 = A Little Dissatisfied
0 = Neither Satisfied nor Dissatisfied
1 = A Little Satisfied
2 = Somewhat Satisfied
3 = Very Satisfied

In the past 4 weeks, how satisfied have you been with...

1. your overall level of physical fitness _____
2. the muscle strength in your legs _____
3. your level of endurance or stamina _____
4. your muscle tone _____
5. the muscle strength in your arms _____
6. your overall level of energy _____
7. your physical ability to do what you want or need to do _____
8. your weight _____
9. your shape _____
10. your overall physical appearance _____

Appendix C

PARASCI: Leisure Time Physical Activity Codes

PARASCI Intensity Classification System

Resistance-LTPA	**Aerobic-LTPA**
- weight lifting	-arm ergometer
- strength training	-treadmill
- arm/chest/trunk exercises	-wheeling
- versa-trainer	-arm/leg ergometer
- thera-band exercises	-standing, standing frame
	-vita glide trainer
	-aerobics
	-walking, walking in brace
	-pool walking
	- swimming
	-dancing
	-FES
	-sit to stand
	-stationary bike
	-hand cycle
	- sports
	- warm-up for sports
	- play with children/grandchildren/pets
	- MacWheelers
	- gardening
	- woodworking

Nothing at all	**Mild**	**Moderate**	**Heavy**
Includes activities that even when you are doing them, you **do not feel like you are working at all.**	Includes physical activities that require you to do **very light work.** You should feel like you are **working a little bit but overall you shouldn't find yourself working too hard.**	Includes physical activities that require **some physical effort**. You should feel like you are working **somewhat hard but you should feel like you can keep going for a long time.**	Includes physical activities that require **a lot of physical effort.** You should feel like you are **working really hard (almost at your maximum)** and can only do the activity for a short time before getting tired. These activities can be **exhausting.**

Appendix D

Equations For Calculating Percentage Body Fat

1. Males TBW = 1.203 + 0.176 weight + 0.449 S^2 / Res

   Females TBW = 3.747 + 0.113 weight + 0.45 S^2 / Res

2. Males FFM = -10.678 + 0.262 weight + 0.625 S^2 / Res + 0.015 Res

   Females FFM = -9.529 + 0.168 weight + 0.696 S^2 /Res + 0.016 Res

3. Males and Females TBF = weight – FFM

4. Males and Females % BF = TBF/weight

Note. TBW = Total body water. FFM = Fat free mass. TBF = Total body fat. %BF = Percentage body fat. S^2 = Stature (height in cm) squared. Res = Resistance. Weight = body weight in kg.

Appendix E

Histograms: Leisure Time Physical Activity Distributions

Figure 1
Distribution of total-LTPA for men

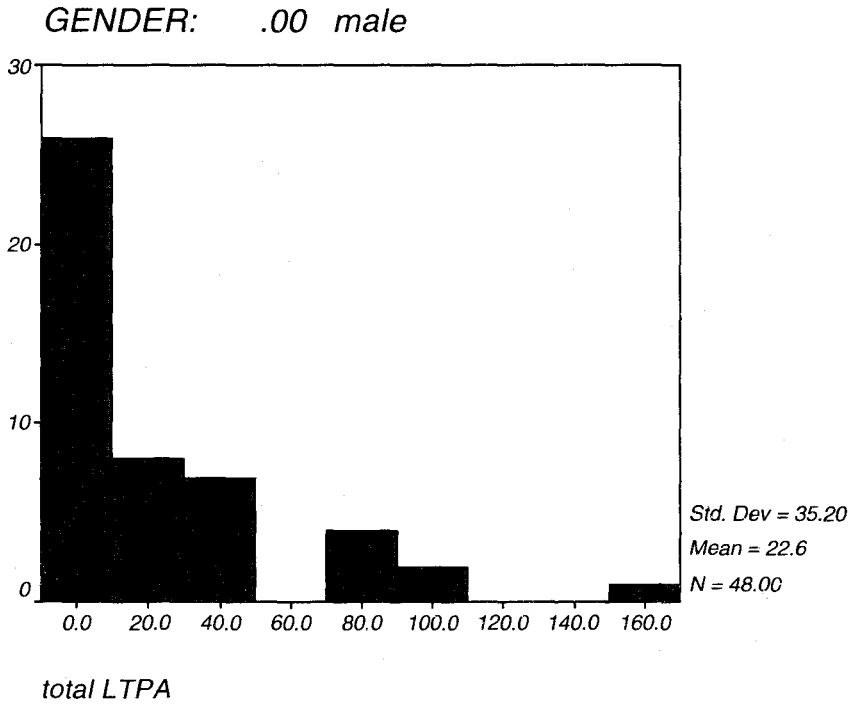

Figure 2
Distribution of total-LTPA for women

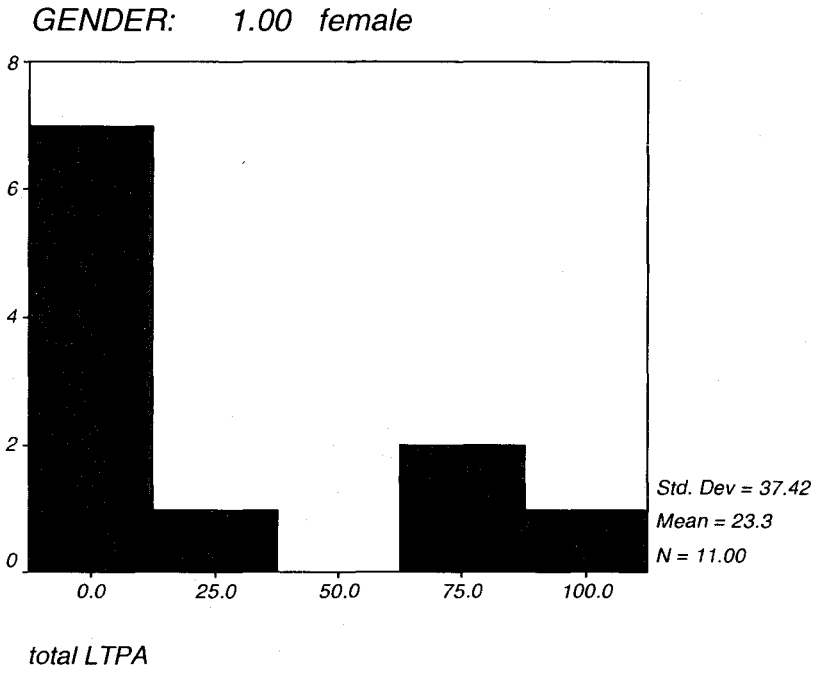

Figure 3
Distribution of heavy-LTPA for men

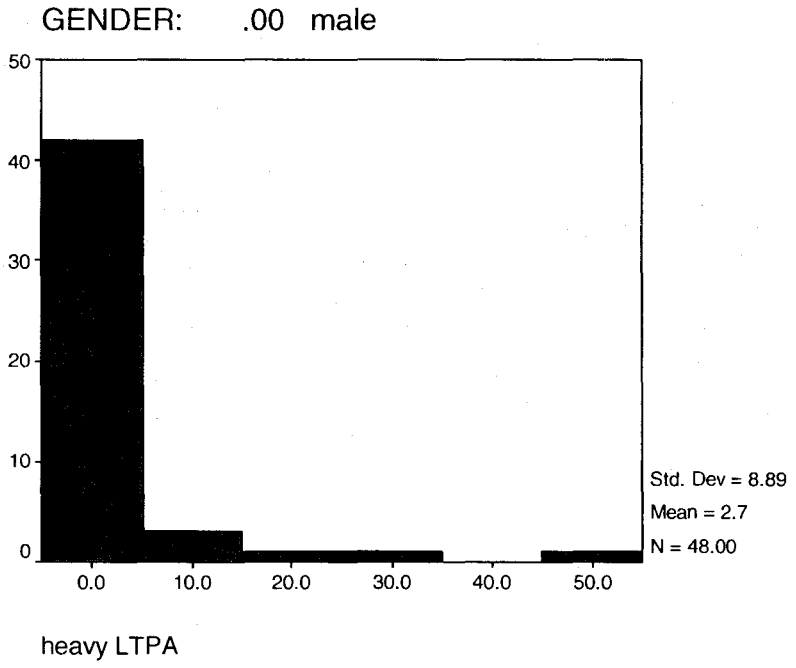

Figure 4
Distribution of heavy-LTPA for women

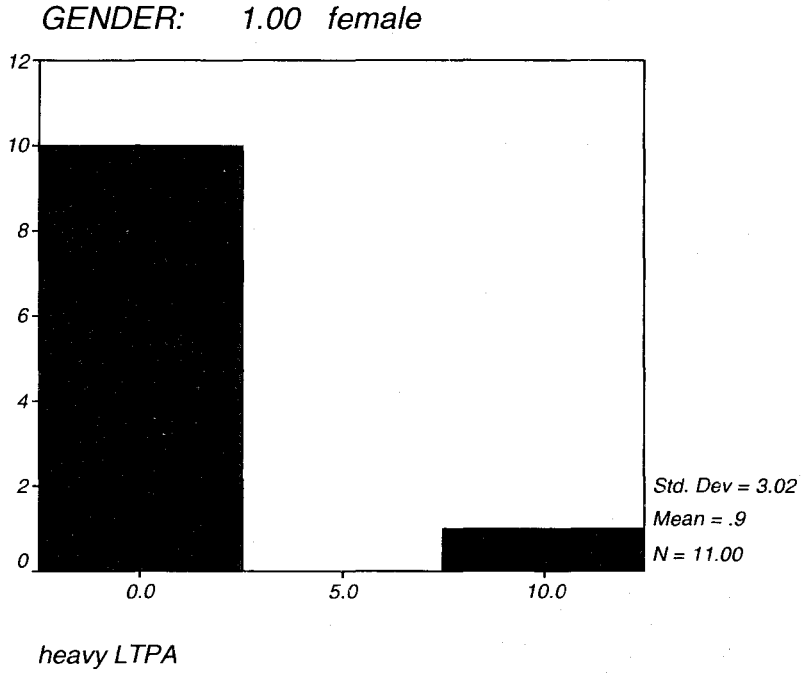

Figure 5
Distribution of moderate-LTPA for men

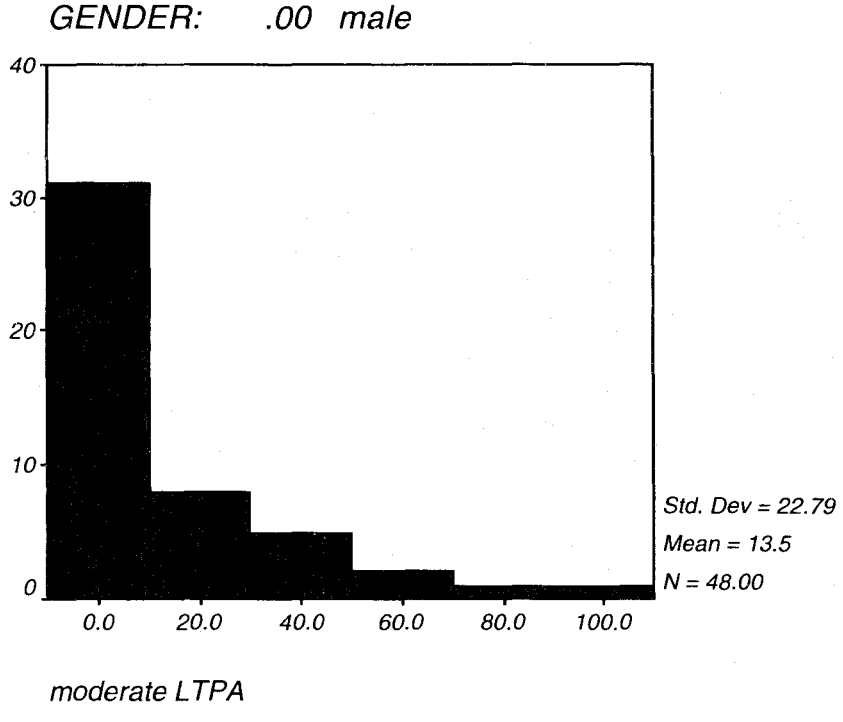

Figure 6

Distribution of moderate-LTPA for women

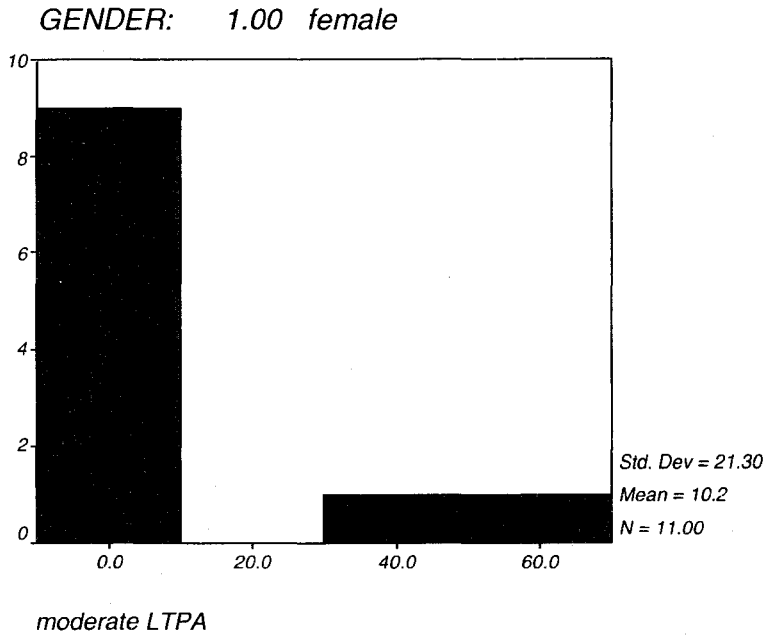

Figure 7

Distribution of mild-LTPA for men

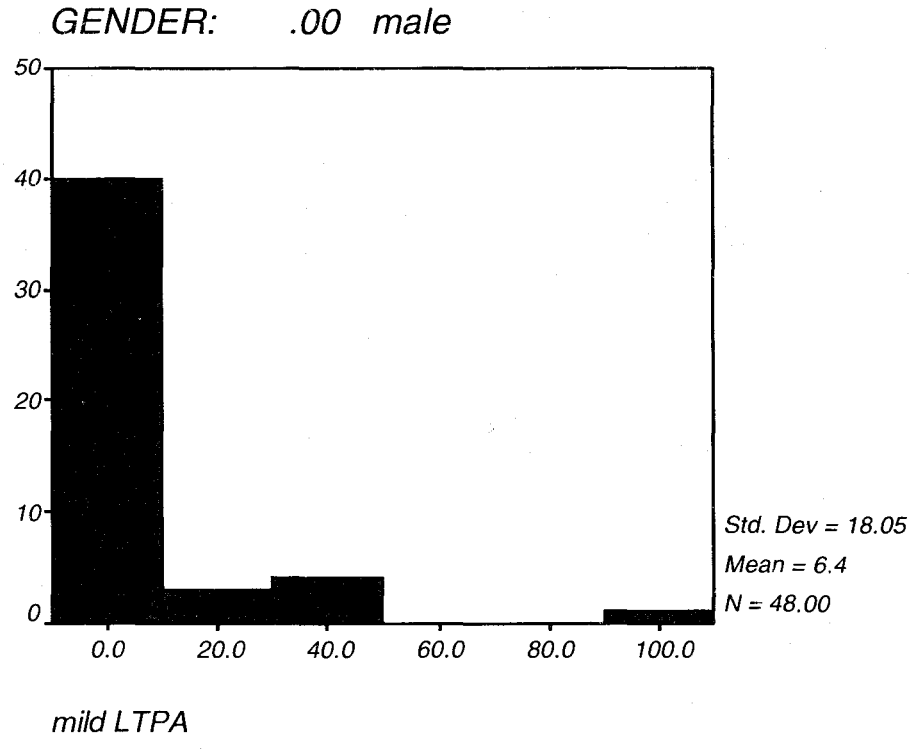

Figure 8

Distribution of mild-LTPA for women

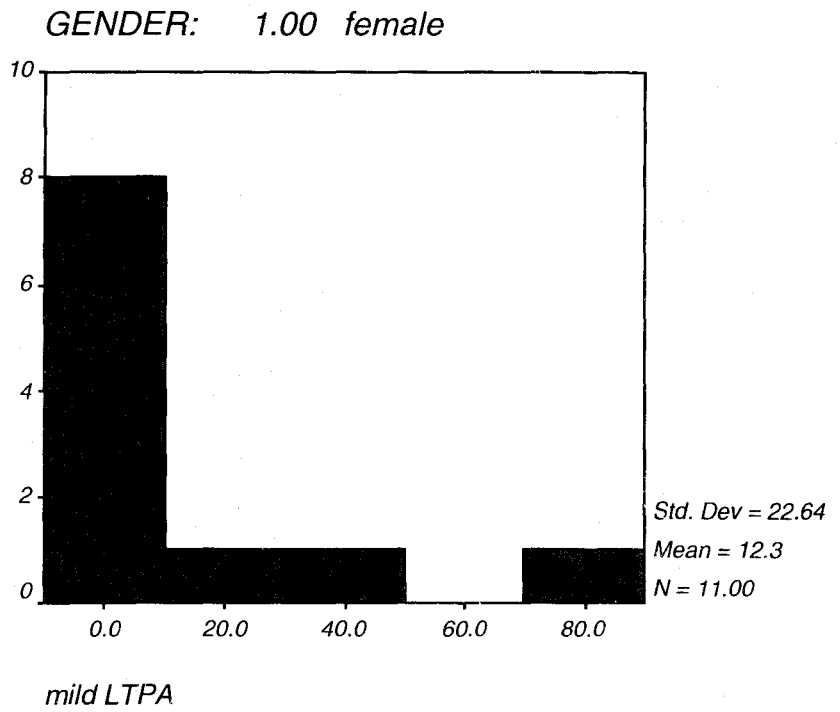

Figure 9
Distribution of aerobic-LTPA for men

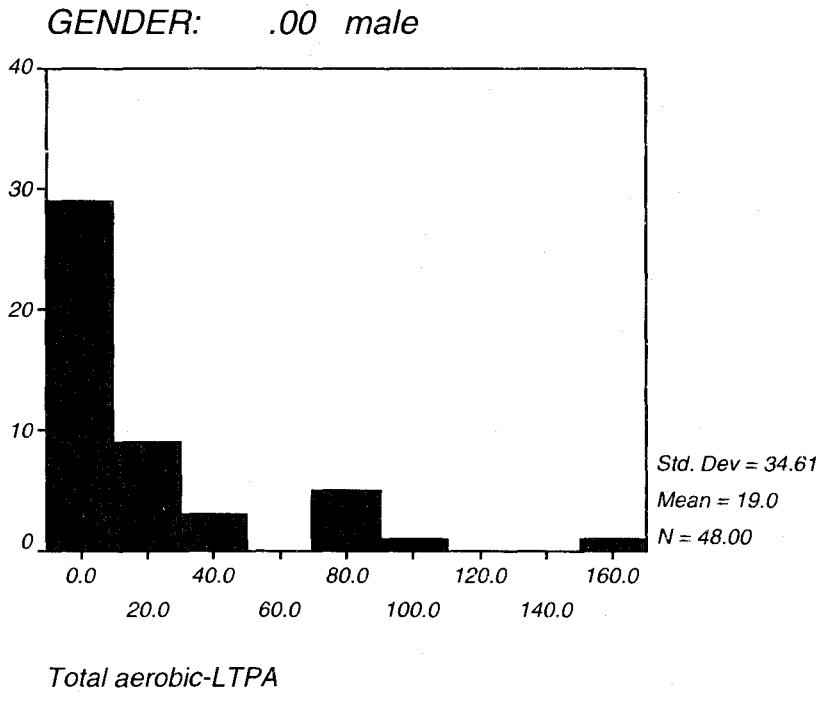

Figure 10
Distribution of aerobic-LTPA for women

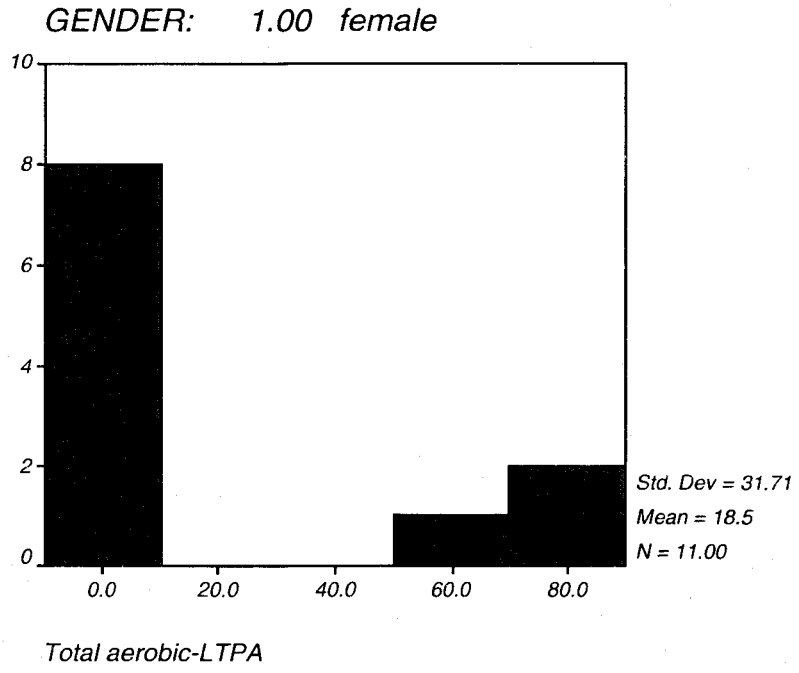

Figure 11
Distribution of resistance-LTPA for men

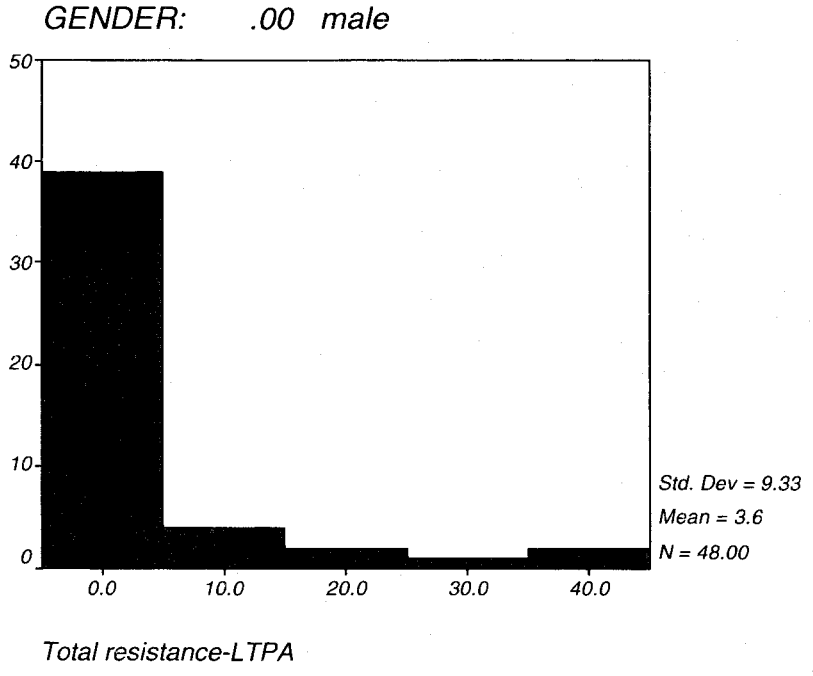

Figure 12

Distribution of resistance-LTPA for women