BODY IMAGE AS A MEDIATOR OF THE RELATIONSHIP BETWEEN BODY WEIGHT AND PSYCHOLOGICAL AND PHYSICAL FUNCTIONING

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Abstract

Objective: This study examined the impact of body image dissatisfaction on physical health and psychosocial functioning. It was proposed that body image dissatisfaction partially mediates the link between weight and negative health consequences. It was also proposed that body image dissatisfaction negatively affects psychosocial functioning.

Method: Analyses were conducted using survey results from 414 participants recruited from University of Hawaii undergraduate Psychology courses. Participants responded online to a survey consisting of self-report measures of body image dissatisfaction, physical health, psychosocial functioning, and health behaviors. Relationships among these variables were examined using Pearson product-moment correlation coefficients. Additionally, multiple regression analyses were used to test the shared variance simultaneously accounted for by body image dissatisfaction, age, and BMI across several outcome variables: physical health, psychosocial functioning, and health behavior. Finally, a path analysis was conducted to test the strength of a mediational model consisting of BMI as the predictor variable, body image dissatisfaction as the mediating variable, and physical and psychosocial functioning as the outcome variables. Results: In men and women, higher BMI was correlated with higher body image dissatisfaction ($r = 0.38$ and $0.34$, respectively) and poorer physical functioning ($r = -0.30$ and -0.14, respectively), but not with measures of psychosocial functioning or health behaviors. On the other hand, higher body image dissatisfaction was associated with both poorer physical functioning ($r = -0.54$ and -0.28, respectively) and increased anxiety, stress, depression, psychosocial functioning impairment, and decreased self-esteem ($r$ ranging from 0.25 to 0.60). A series of multiple regression models were tested with age, BMI, and body image dissatisfaction scores as independent variables. Only body image
dissatisfaction emerged as a significant predictor of physical functioning, anxiety, stress, depression, and psychosocial functioning. While increased body image dissatisfaction was a predictor of decreased self-esteem, increased BMI was a predictor of increased self-esteem. A path analyses was conducted on those with a BMI of 23 kg/m² or above. A model was examined in which body image dissatisfaction partially mediated the effect of BMI on physical functioning and psychosocial functioning; however, the model was a poor fit for the data (TLI = -0.29, CFI = 0.79, RMSEA = 0.31 [90% C.I. 0.22-0.41]).

Discussion: BMI was correlated with body image dissatisfaction and physical functioning, but not with any measures of psychosocial functioning, whereas body image dissatisfaction was correlated with measures of physical and psychosocial functioning. Furthermore, in multiple regression analyses, BMI did not account for a significant amount of variance in physical functioning while increased body image dissatisfaction predicted poorer physical functioning. These findings lend support to a model in which the association between BMI and physical functioning is mediated by body image dissatisfaction. However, a path analysis found that this model was not a good fit for the data. This may be due to a small sample size used for the path analysis and unanalyzed variables that may also play an important role in the connection between weight and health. Nevertheless, these findings contribute to a body of research suggesting that body image dissatisfaction may be an important target for health interventions and that societal obesity stigma needs to be addressed.
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Introduction

In recent decades, rates of overweight and obesity have increased throughout most of the world (World Health Organization, 1999), and now over 60% of adults in the United States are classified as overweight (Body Mass Index [BMI] greater than 25 kg/m²) or obese (BMI greater than 30 kg/m²) (Ogden et al., 2006). The problem of obesity is commonly considered one of the greatest health crises currently faced in the United States (Oliver, 2006) and other Western countries (Chiolero, 2009). A preponderance of research links obesity to both increased mortality and morbidity (Bray, 2004; Calle, Rodriguez, Walker-Thurmond, & Thun, 2003; Patterson, Frank, Kristal, & White, 2004; Yan et al., 2006). Subsequently, there is great interest in identifying the mechanisms of this relationship. However, research has largely focused on the direct biological effects of adiposity, or fat cells, on disease, while ignoring the role of psychosocial factors, which are increasingly acknowledged as equally important to understanding disease (Muennig, Jia, Lee, & Lubetkin, 2008).

When considering health outcomes of obesity, of particular concern is Health-Related Quality of Life (HRQL), those aspects of quality of life that affect physical and mental health (U.S. Department of Health and Human Services, 2000). Much of the impact of obesity is felt through chronic and disabling medical conditions, such as diabetes mellitus, heart disease, and certain forms of cancer (Kim & Popkin, 2006), and obesity has been linked to a loss of quality adjusted life years (Muennig, Lubetkin, Jia, & Franks, 2006). Increased BMI is associated with increased HRQL impairment, both within and between BMI levels (Kolotkin, Crosby, & Williams, 2002). It is also important to consider the long-term psychosocial impact of obesity. Beyond
psychosocial disruptions caused by chronic illness (de Ridder, Geenen, Kuijer, & van Middendorp, 2008), prevalent weight-bias frequently results in social and economic discrimination against persons with obesity (Puhl & Heuer, 2009).

**Biopsychosocial Approach to Health**

The impact of psychosocial factors on health has been strongly indicated by research conducted using a biopsychosocial approach that allows for and investigates complex interactions among psychosocial and physiological factors involved in health conditions (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). This research has identified a number of psychosocial factors such as chronic stress, depression, and social isolation that play a major role in a number of diseases (Cohen, Janicki-Deverts, & Miller, 2007; Kiecolt-Glaser et al., 2002). Importantly, psychosocial factors likely contribute directly as well as indirectly to disease (G. Miller, Chen, & Cole, 2009). For example, chronic stress is implicated in HIV progression and susceptibility to viral illnesses (Cohen et al., 2007). Stress may indirectly affect outcomes through reduced adherence to medication regimes; at the same time, research suggests that the increased autonomic nervous system activity characteristic of stress may directly increase HIV replication (Cohen et al., 2007). These findings suggest that to focus solely on the physiological pathways linking obesity and negative health consequences is myopic. Unfortunately, although attention has been given to psychosocial risk factors for the development of obesity, very few studies have examined the role of psychosocial factors in the development and maintenance of the negative health outcomes associated with obesity.
It may be that psychosocial factors are given less weight because of a common assumption that body fat itself is the primary cause of elevated rates of conditions such as hypertension and metabolic syndrome seen in obese persons (Muennig et al., 2008). Specifically, the predominant view is that adipose cells induce biochemical changes that negatively impact the body. These include increased levels of pro-inflammatory and pro-thrombotic cytokines and autonomic and hormonal dysfunction (Muennig & Bench, 2009). However, Muennig, Jia, Lee and Lubetkin (2008) caution that although these biochemical changes are certainly correlated with adiposity, causality has not been clearly established.

Muennig and colleagues (2008) note that the same hormonal elevations attributed to adiposity are also seen in people experiencing chronic stress, suggesting that psychosocial factors could also plausibly explain these elevations. They argue that additional research findings indicate that, at the very least, the direct effect of fat cells on health does not comprise the whole picture. First, overweight people (BMI between 25 kg/m² and 30 kg/m²) may actually experience lower morbidity and mortality than non-overweight people (BMI less than 25 kg/m²) (see Flegal, Graubard, Williamson, & Gail, 2005). Furthermore, the health consequences of overweight and obesity are differentially experienced according to gender and ethnicity. Importantly, these differences in health consequences mirror differences in sociocultural views of body ideals and adiposity. Specifically, a number of studies have found that groups that demonstrate more emphasis on a thin body ideal experience more negative health outcomes at lower BMI levels (Cash, Phillips, Santos, & Hrabosky, 2004; Fontaine, Redden, Wang, Westfall, & Allison, 2003; Kolotkin et al., 2002; Paeratakul, White, Williamson, Ryan, & Bray,
For example, in a large community-based survey, overweight women lost 7 times more quality-adjusted life years than overweight men, and overweight Non-Hispanic Whites, but not overweight Blacks, experienced a net excess mortality (Fontaine et al., 2003). This suggests the possibility that distress related to body size, or body image dissatisfaction, contributes to negative health outcomes (Muennig et al., 2008).

**Body Image Dissatisfaction**

Body image dissatisfaction is the disliking and disparaging of one’s body (M. A. Friedman & Brownell, 1995). According to the sociocultural model of body image dissatisfaction, sociocultural groups hold collective body image ideals (Wilson, Tripp, & Boland, 2005). Individuals who internalize these ideals and perceive a discrepancy between their weight or size and the ideal weight or size experience body image dissatisfaction (Thompson & Stice, 2001). Notably, sociocultural body ideals and their importance vary across sociocultural groups; for example, it is commonly found that women hold thinner body ideals than men (K. J. Miller et al., 2000). The range of socially acceptable body sizes may be wider for men, and many men desire bigger, more muscular bodies (McCabe & Ricciardelli, 2004). Differences in body ideals have also been found among ethnicities, for example, Non-Hispanic Whites and Asian-Americans hold thinner body ideals and evaluate their weight and appearance more negatively compared to Blacks and Pacific Islanders (Cash, Morrow, Hrabosky, & Perry, 2004; Gluck & Geliebter, 2002; Wilkinson, Ben-Tovim, & Walker, 1994).

**Body image dissatisfaction and obesity.** In western countries, the primary body ideal is lean for women and lean and muscular for men (Oehlhof, Musher-Eizenman, Neufeld, & Hauser, 2009). Moreover, there is a strong cultural bias against adiposity
(Puhl & Heuer, 2009). It follows that increased BMI would be associated with body image dissatisfaction. Indeed, obese people generally experience more body image dissatisfaction than non-obese people (Sarwer, Thompson, & Cash, 2005). Some studies have failed to find an association between BMI and body image dissatisfaction in samples of people seeking weight loss treatment, and it may be that levels of body image dissatisfaction are relatively stable within certain BMI thresholds, but increase when those thresholds are crossed. In non-clinical samples, a clearer positive association between BMI and body image dissatisfaction has emerged (Sarwer et al., 2005).  

**Body Image Dissatisfaction and Health Outcomes**

As described above, groups that place more importance on a thin body ideal appear to experience disproportionately negative health outcomes at lower BMI levels than those who demonstrate more acceptance of adiposity levels (Cash, Phillips, et al., 2004; Fontaine et al., 2003; Kolotkin et al., 2002; Paeratakul et al., 2002), suggesting that body image dissatisfaction may impact health outcomes. Recent studies have examined this possibility and provide preliminary evidence that body image dissatisfaction may play an important role in both physical health and psychosocial functioning.

Two studies conducted by Muennig and colleagues support the proposition that body image dissatisfaction mediates the relationship between BMI and health among overweight and obese persons. Muennig and colleagues (2008) examined participants with a BMI greater than 23 kg/m² in the 2003 Behavioral Risk Factor Surveillance System data set. They found that current-ideal weight discrepancy ([current weight – desired weight]/current weight X 100) predicted mental and physical health (as measured by unhealthy days due to mental health and physical health problems in the last month)
more strongly than BMI predicted mental and physical health. In a subsequent study, Muennig and Bench (2009) found that in a Dominican Republic community characterized as not stigmatizing obesity, BMI was not associated with self-rated health. In both studies, the authors used current-ideal weight discrepancy as the predictor of health. This discrepancy is often used as a measure of body image dissatisfaction; however, although it is correlated with measures of body image dissatisfaction, as a single item measure, it is limited in its ability to capture disparagement of one’s size (Cash, 2002).

There are a number of plausible ways in which body image dissatisfaction may directly lead to physiological effects that impact health. For example, body image dissatisfaction may impact health behaviors; it is associated with dieting behavior (C. N. Markey & Markey, 2005; Puttermann & Linden, 2004), and avoidance of physical activity (Markland, 2009). In addition, body image dissatisfaction is linked to increased stress and depressive symptoms and decreased self-esteem (K. E. Friedman, Reichmann, Costanzo, & Musante, 2002; Johnson & Wardle, 2005).

Notably, research on the relationship between BMI and psychological functioning has found mixed results. Literature reviews and meta-analyses conclude that there is no consistent, significant relationship between BMI and psychological functioning (Faith, Calamaro, Dolan, & Pietrobelli, 2004; Faith, Matz, & Jorge, 2002; McElroy et al., 2004), and that psychological functioning impairment is minimal in unselected samples (M. A. Friedman & Brownell, 1995). However, these equivocal findings may reflect research designs that focus on simple associations between BMI and psychological functioning; more useful results may be found by examining mediating and moderating variables.
(Faith et al., 2002; M. A. Friedman & Brownell, 1995). Gender is a potential moderator; for example, Onyike, Crum, Lee, Lyketsos, & Eaton (2003) found increased rates of depression in obese women but not in obese men and Faith, Flint, Fairburn, Goodwin & Allison (2001) found that BMI was associated with neuroticism in women, but not men.

Specifically, there is some evidence that body image dissatisfaction mediates associations between obesity and psychological functioning in women and weight-loss treatment seekers. Mond and colleagues (2007) examined self-reported body image, eating disorder psychopathology, and psychological functioning in a community sample of obese (n = 639) and non-obese (n = 4253) women. They found that weight and shape concerns accounted for the shared variance between obesity and functional impairment. Interestingly, they did not find that binge eating frequency mediated the relationship between obesity and functional impairment when controlling for body image dissatisfaction. Similarly, in a study looking at severely obese residents at a weight-loss facility, K. E. Friedman et al. (2002) found that body image dissatisfaction mediated the association between overweight and negative affect.

The studies conducted by Muennig and colleagues (2008; 2009), Friedman and colleagues (2002), and Mond and colleagues (2007) all support the proposition that body image dissatisfaction may affect both physical health and psychosocial functioning. However, a mediational model linking BMI, body image dissatisfaction, and physical health remains to be tested. Additionally, the use of current-ideal weight discrepancy (as in Muennig et al., 2008) is not an adequately comprehensive method for measuring the construct of body image dissatisfaction. The current study will extend past research by testing a mediational model and using a multi-item instrument designed to capture
cognitive and affective aspects of body image dissatisfaction (the Body Shape Questionnaire; BSQ). This study will also add to our understanding of the relationship between BMI, body image dissatisfaction, and psychosocial outcomes by examining a non-dichotomized, non-clinical sample.

**Study Aims**

The present study seeks to better understand the role of body image dissatisfaction in HRQL, health behaviors, and psychosocial functioning. In order to better understand the relationship of body image dissatisfaction and health more generally, associations between body image and HRQL, psychosocial functioning (depression, stress, anxiety, and self-esteem), and health behaviors (physical activity and healthy eating) will be examined. It is hypothesized that body image dissatisfaction will be negatively associated with physical activity and healthy eating, and that these associations will remain when controlling for age and BMI. Similarly, it is hypothesized that body image dissatisfaction will be negatively associated with psychological functioning after controlling for age and BMI.

The primary research hypothesis is that in a non-clinical sample of overweight and obese persons, body image dissatisfaction will mediate a negative association between BMI and physical functioning. Additionally, it is hypothesized that in women, body image dissatisfaction will mediate a negative association between BMI and psychosocial functioning. This is not predicted in men, as BMI is not expected to be significantly associated with psychosocial functioning in men; however, it is predicted that body image dissatisfaction will be negatively associated with psychosocial functioning in men.
Methods

Participants

This study was conducted using data collected previously. 414 participants were recruited from University of Hawaii at Manoa undergraduate Psychology courses and received extra credit for their participation.

Procedure

Participants were given an internet address with which to access the survey. The informed consent form was presented first, and then participants were presented with a series of questions and measures. Participants were required to answer all questions in order to proceed to the next page, and data were stored when participants clicked a button to continue to the next page. Participants were able to leave the internet survey at any time, but could not continue at a later time. When participants left or completed the survey, they were presented with a debriefing form explaining the purpose of the study, providing the investigator’s contact information, and directing participants to agencies offering psychological support and information regarding disordered eating.

Measures

Demographics. Information about age, gender, ethnicity, and education was collected from all participants. Self-reported height and weight were also collected, and at the end of the survey, participants were asked to weigh themselves and report that weight, if they had access to a scale at that time.

Body Shape Questionnaire – 16 item version A (BSQ: P. J. Cooper, Taylor, Cooper, & Fairburn, 1987; BSQ-16A: Evans & Dolan, 1993). The BSQ is a 34 item self-report measure designed to assess participants’ cognitive and affective weight and shape
dissatisfaction, desire to lose weight, and fear of gaining weight. Evans and Dolan (1993) tested two 16 item shortened forms of the BSQ, and found that both were highly correlated with the full 32-item scale (.96 to .99) in a sample of White women. The Cronbach’s coefficient alpha values of both scales were in the range of .93 and .96. The BSQ 16-item version A was used in this study. It includes items such as “Have you worried about your flesh being not firm enough?” and “Has eating even a small amount of food made you feel fat?” on a six-point Likert scale ranging from “never” to “always.” Higher scores indicate greater weight and shape concerns. The BSQ has shown acceptable concurrent and criterion validity, including in samples of obese men and women (Rosen, Jones, Ramirez, & Waxman, 1996).

**Rand 36-Item Health Survey – Version 1.0** (SF-36; Hays, Sherbourne, & Mazel, 1993). The SF-36 is a self-report measure of health-related quality of life. The SF-36 contains 36 items with the response scales varying by question (sample items: “In general, how would you rate your health?” 1= “Excellent” 2= “Very Good” 3= “Good” 4= “Fair” 5= “Poor”; “How much of the time in the past 4 weeks … did you have a lot of energy?” 1= “All of the time” 2= “Most of the time” 3= “A good bit of the time” 4= “Some of the time” 5= “A little of the time” 6 = “None of the time”). The SF-36 yields eight subscales: Physical Functioning subscale (10 items, 21 levels ), Bodily Pain (2 items, 11 levels), Role Limitations due to Physical Health Problems (4 items, 5 levels), Role Limitations due to Personal or Emotional Problems (3 items, 4 levels), General Mental Health (5 items, 26 levels), Social Functioning (2 items, 9 levels), Energy/Fatigue (Vitality) (4 items, 21 levels), General Health Perceptions (5 items, 21 levels). An additional item provides an indication of perceived change in health. For this study, two
summary measures were used: the Physical Component Summary (SF-36 PCS; derived from the Physical functioning, Bodily pain, Role limitations due to physical health problems, and General health perceptions subscales) and the Mental Component Summary (SF-36 MCS; derived from the Role limitations due to personal or emotional problems, General mental health, Social functioning, and Energy/fatigue (vitality) subscales). Higher scores indicate better functioning. Internal consistency is adequate across the subscales, ranging from 0.78 to 0.93, and the instrument has demonstrated good construct validity (McHorney, Ware, & A. E. Raczek, 1994).

**Depression Anxiety Stress Scale – 21 item version** (DASS-21; S. H. Lovibond & Lovibond, 1995). The DASS is a 42-item self-report measure of psychological functioning. Henry and Crawford (2005) created a shortened version with a cleaner factor structure, the DASS-21. The DASS-21 consists of 21 items that respondents rate on a 4-point Likert scale according to their experience in the previous week, ranging from “Did not apply to me at all” to “Applied to me very much, or most of the time.” The DASS-21 yields 3 subscales: Depression (DASS-D), Anxiety (DASS-A), and Stress (DASS-S). Each subscale is based on 7 items. The DASS-D assesses dysphoric mood and includes items such as “I couldn't seem to experience any positive feeling at all” and “I felt down-hearted and blue.” The DASS-A assesses fear and symptoms of physical arousal with items such as “I felt scared without any good reason” and “I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).” The DASS-S assesses symptoms of stress, particularly tension and irritability, and includes items such as “I found it difficult to relax” and “I tended to over-react to situations.” All three subscales demonstrate good internal
consistency (Cronbach’s alpha: Depression= 0.94, Stress= 0.91, Anxiety= 0.87) and validity in clinical and nonclinical samples (Antony, Bieling, Cox, Enns, & Swinson, 1998).

**Rosenberg Self-Esteem Scale** (RSES; Rosenberg, 1989). The RSES is a 10-item self-report measure of global self-esteem. Originally, the items were rated on a Guttman scale, but the current common practice is to use a 4-point Likert format, ranging from “strongly disagree” to “strongly agree.” Sample items include “I feel that I'm a person of worth, at least on an equal plane with others” and “I certainly feel useless at times” (reversed). Higher scores indicate more positive orientation to oneself. This scale has demonstrated high reliability; across many studies the typical findings are Chronbach’s alphas that range between .77 and .88 and test-retest correlations between .82 and .88 (Blascovich and Tomaka, 1993 and Rosenberg 1986). The RSES is a very frequently used measure and has demonstrated good validity (Demo, 1985; Robinson & Shaver, 1973).

**Baecke Physical Activity Questionnaire** (BPAQ; Baecke, Burema, & Frijters, 1982). The BPAQ is a 24-item self-report questionnaire assessing habitual levels of physical activity in three domains: work, leisure, and sports. Most items are rated on a 5-point scale, with response sets varying by item. Sample items include “at work/school I lift heavy loads” and “during leisure time I sweat.” Participants are also asked what if any sports they participate in and the frequency of that participation. For scoring purposes, sports are assigned one of three levels of intensity. The BPAQ has shown good reliability, with test-retest correlations ranging from 0.74 to 0.90 (Baecke et al., 1982),
and good convergent validity with measured physical activity levels (Philippaerts, Westerterp, & Lefevre, 2007).

**Healthy Food Consumption.** Questions were constructed for this study inquiring into the number of servings of fruits, vegetables, and whole grains consumed daily by participants. For each food category, participants were provided examples of serving sizes (e.g., “A serving of fruit is 1 medium sized fruit (the size of a tennis ball), 1/2 cup of chopped fruit (the size of a light bulb) or 3/4 cup of fruit juice (the size of a small Styrofoam cup)” and then asked how many servings they consume on a typical day. For the purpose of analysis, responses to all three items were combined to create an overall measure of healthy food consumption.

**Statistical Analysis**

**Gender.** Gender is an important issue when considering body image dissatisfaction. Whereas the western body image ideal for women is primarily centered around thinness, the body image ideal for men emphasizes musculosity in addition to lack of body fat. Thin men, unlike thin women, often express a desire to increase their size (Oehlhof et al., 2009; Smolak & Murnen, 2008). Moreover, the primary measure of body image dissatisfaction, the BSQ, was designed for use with women. Because of this, analyses were run separately for men and women.

**Pearson-Product Moment Correlations.** Pearson product-moment correlation coefficients were computed across the variables of interest: body image dissatisfaction (as measured by the BSQ), BMI, age, self-esteem (as measured by the RSES), depression (as measured by the DASS-D), anxiety (as measured by the DASS-A), and stress (as measured by the DASS-S), the mental component of HRQL (as measured by the SF-36
MCS), the physical component of HRQL (as measured by the SF-36 PCS), and measures of health behaviors including physical activity (as measured by the BPAQ) and healthy eating (as measured by the sum of three items constructed for this study).

**Multiple Regression Models.** In order to test for variance accounted for simultaneously by body image dissatisfaction, age, and BMI, several multiple regression analyses were conducted using the 3 predictor variables: body image dissatisfaction (as measured by the BSQ), age, and BMI. Outcome measures included measures of psychosocial functioning, including self-esteem (as measured by the RSES), depression (as measured by the DASS-D), anxiety (as measured by the DASS-A), and stress (as measured by the DASS-S), the mental component of HRQL (as measured by the SF-36 MCS), the physical component of HRQL (as measured by the SF-36 PCS), and measures of health behaviors including physical activity level (as measured by the BPAQ) and healthy food consumption (measured by 3 items constructed for this study). This method mirrored the design used by Muennig et al. (2008) to examine current – ideal weight discrepancy as a predictor of mental and physical unhealthy days.

**Path Analysis with Measured Variables.** In order to test the theoretical model described in Figure 1, a path analysis was conducted to examine the statistical relationships between BMI, body image dissatisfaction, physical functioning, and psychosocial functioning. Specifically, this analysis tested the strength of a model in which body image dissatisfaction (as measured by the BSQ) mediates a negative relationship between BMI and physical health (SF-36 PCS) and, in women, a negative relationship between BMI and psychosocial functioning (as measured by the mental components subscale of the SF-36, the DASS-D, the DASS-A, the DASS-S, and the
RSES). In men, this model postulates that body image dissatisfaction will decrease psychosocial functioning; however, BMI was not expected to be directly related to psychosocial functioning. As the population of interest is people who are overweight or obese, this analysis was conducted using a subset of the participants who have a BMI at or above kg/m² (n = 135). A cutoff of 23 kg/m² was selected to increase sample size and because the sample includes many people of Asian ethnicity, for whom 23 kg/m² has been proposed to be a better cutoff than 25 kg/m² for the designation of overweight (WHO expert consultation, 2004). Correlations and regression analyses described above, however, were conducted using the entire sample, in order to capture the full range of BMI values.

Figure 1. Theoretical model of the mediational role of body image dissatisfaction in the association between BMI and physical and psychosocial functioning. BMI will be computed using self-reported height and weight. Body Image Dissatisfaction will be measured by a) Body Shape Questionnaire score and b) the ratio of self-reported current weight to ideal weight. Physical Health will be measured by the Physical Component Summary of the Rand 36-Item Health Survey. Psychosocial Functioning will be measured by a) the Mental Component Summary of the Rand 36-Item Health Survey b) the Depression Anxiety Stress Scale and c) the Rosenberg Self-Esteem Scale.
Results

Sample Characteristics

A total of 414 participants were included in the following analyses. Participants' ages ranged from 18-55, with a mean of 21.48 ($SD = 4.94$). Participants included 128 males and 286 females, 92.8% of whom classified themselves as heterosexual, 3.4% as homosexual, and 3.9% as bisexual. Participants’ ethnicities were varied and often multiple: 36.5% described themselves as being of multiple ethnicities, 39.6% as Asian, 19.1% as Caucasian, 1.9% as Hispanic, 1.4% as Pacific Islander, and 1.4% as African-American. The great majority of participants were undergraduate students who had not yet completed a 4 year college degree (91%). Participant BMIs ranged from 15.35 to 49.92, with a mean of 23.58 ($SD = 5.15$) and median of 22.46. According to BMI-based classifications, 7.2% of participants were underweight, 66.7% were normal weight, 16.4% were overweight, and 9.7% were obese. The mean age for males was 21.31 ($SD = 4.86$) and the mean age for females was 21.56 ($SD = 4.98$). Males had a mean BMI of 24.11 ($SD = 4.42$), while females had a mean BMI of 23.34 ($SD = 5.43$).

Correlations

Table 1 presents the correlations of BMI and body image dissatisfaction (as measured by the BSQ and perceived desired weight discrepancy) with measures of physical functioning (SF-36 PCS), psychological functioning (DASS-A, DASS-S, DASS-D, SF-36 MCS, and RSES), and health behaviors (B-PAQ and healthy food servings). Higher BMI was significantly associated with greater body image dissatisfaction, as shown by BSQ scores in men and women ($r_s = 0.38$ and 0.34, respectively). Higher BMI was also significantly associated with poorer physical
functioning, as shown in the SF-36 PCS ($r_s = -0.30$ and -0.14, respectively). Notably, BMI was not statistically significantly associated with any other measure in either men or women. Higher BSQ scores were significantly associated with increased anxiety, stress, depression, psychosocial functioning impairment, and decreased self-esteem ($r_s$ ranging from 0.25 to 0.60). Men showed significantly stronger associations between BSQ scores and DASS-A ($r_s = -0.52$ vs. 0.25, $p<0.01$), DASS-S ($r_s = 0.61$ vs. 0.28, $p<0.01$), and DASS-D ($r_s = 0.61$ vs. 0.35, $p<0.05$) scores than women. BSQ scores were also negatively associated with physical functioning in both men and women ($r_s = -0.54$ and -0.28, respectively), and Fisher’s z-transformation of correlation showed that the correlation was significantly stronger in men than in women ($p < 0.01$).
Table 1

Correlations between BMI, Body Image Dissatisfaction and Psychosocial and Physical Functioning, Separated by Gender

<table>
<thead>
<tr>
<th></th>
<th>BSQ</th>
<th>PDWD</th>
<th>DASS-A</th>
<th>DASS-S</th>
<th>DASS-D</th>
<th>RSES</th>
<th>B-PAQ</th>
<th>Healthy Servings</th>
<th>SF-36 PCS</th>
<th>SF-36 MCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BMI</td>
<td>0.27**</td>
<td>0.73**</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
<td>0.02</td>
<td>-0.10*</td>
<td>0.07</td>
<td>-0.22**</td>
<td>-0.04</td>
</tr>
<tr>
<td>BSQ</td>
<td>0.55**</td>
<td>0.32**</td>
<td>0.38**</td>
<td>0.34**</td>
<td>-0.42**</td>
<td>-0.09</td>
<td>0.11*</td>
<td>0.11</td>
<td>-0.33**</td>
<td>-0.34**</td>
</tr>
<tr>
<td>PDWD</td>
<td>0.07</td>
<td>0.14**</td>
<td>0.11*</td>
<td>-0.11</td>
<td>-0.15**</td>
<td>0.02</td>
<td></td>
<td></td>
<td>-0.29**</td>
<td>-0.15**</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BMI</td>
<td>0.35**</td>
<td>0.68**</td>
<td>0.07</td>
<td>0.16</td>
<td>0.10</td>
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<td>BSQ</td>
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<td>0.52**</td>
<td>0.61**</td>
<td>0.61**</td>
<td>-0.46**</td>
<td>-0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>-0.53**</td>
<td>-0.33**</td>
</tr>
<tr>
<td>PDWD</td>
<td>0.11</td>
<td>0.26**</td>
<td>0.26**</td>
<td>-0.21*</td>
<td>-0.08</td>
<td></td>
<td></td>
<td></td>
<td>-0.35**</td>
<td>-0.15</td>
</tr>
<tr>
<td><strong>Women</strong></td>
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<td></td>
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<tr>
<td>BMI</td>
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<td>0.86**</td>
<td>0.08</td>
<td>0.05</td>
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<td>-0.19</td>
<td>0.09</td>
<td>-0.21*</td>
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<tr>
<td>BSQ</td>
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<td>0.25**</td>
<td>0.28**</td>
<td>0.35**</td>
<td>-0.44**</td>
<td>-0.04</td>
<td>0.14*</td>
<td>0.14</td>
<td>-0.30**</td>
<td>-0.33**</td>
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<tr>
<td>PDWD</td>
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<td>0.04</td>
<td>0.09</td>
<td>-0.05</td>
<td>-0.15*</td>
<td>0.08</td>
<td></td>
<td></td>
<td>-0.29**</td>
<td>-0.11*</td>
</tr>
</tbody>
</table>

*Note.* BSQ = Body Shape Questionnaire, PDWD = Perceived Desired Weight Discrepancy, DASS-A = Depression Anxiety and Stress Scale – Anxiety Subscale, DASS-S = Depression Anxiety and Stress Scale – Stress Subscale, DASS-D = Depression Anxiety and Stress Scale – Depression Subscale, RSES = Rosenberg Self-Esteem Scale, B-PAQ = Baecke Physical Activity Questionnaire, SF-36 PCS = Rand 36-Item Health Survey – Physical Component Summary, and SF-36 MCS = Rand 36-Item Health Survey – Mental Component Summary.

*p < 0.05. **p < 0.01.
Multiple Regression Analyses

Tables 2 and 3 present the results of a series of multiple regression analyses using age, BMI, and BSQ scores as the independent variables, and measures of physical functioning (SF-36 PCS), psychological functioning (DASS-A, DASS-S, DASS-D, SF-36 MCS, and RSES), and health behaviors (B-PAQ and healthy food consumption) as the dependent variables, separately in men (table 2) and women (table 3). All three independent variables were entered simultaneously. The results of these analyses largely followed the same pattern in men and women. The regression models accounted for a significant proportion of variance in physical functioning as measured by SF-36 PCS scores in men (adjusted $R^2 = 0.28$, F = 16.99, $p<0.01$) and women (adjusted $R^2 = 0.09$, F = 9.79, $p<0.01$), with only body image dissatisfaction, as measured by BSQ, contributing significantly to the models. Similarly, the regression models accounted for a significant proportion of variance in psychological functioning as measured by SF-36 MCS, DASS-A, DASS-S, and DASS-D scores in men (adjusted $R^2$s ranging from 0.09 to 0.36, $p<0.01$) and women (adjusted $R^2$s ranging from 0.05 to 0.11, $p<0.01$). Again, only body image dissatisfaction, as measured by BSQ, contributed significantly to the models. The regression models with self-esteem as the dependent variable diverged slightly from this pattern. The regression models accounted for a significant proportion of variance in self-esteem as measured by RSES scores in men (adjusted $R^2 = 0.25$, F = 14.51, $p<0.01$) and women (adjusted $R^2 = 0.21$, F = 25.01, $p<0.01$) and BSQ was a significant predictor in both. However, in these models, BMI was also a significant predictor; higher BMI predicted higher RSES scores.
Table 2
Multiple Regression Models of Age, BMI, and BSQ as Predictors of Psychosocial and Physical Functioning in Males

<table>
<thead>
<tr>
<th>DV</th>
<th>Adjusted $R^2$</th>
<th>F</th>
<th>IV</th>
<th>$\beta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36 PCS</td>
<td>0.27</td>
<td>15.33**</td>
<td>Age</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.50**</td>
</tr>
<tr>
<td>SF-36 MCS</td>
<td>0.10</td>
<td>5.15**</td>
<td>Age</td>
<td>-0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
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<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.38**</td>
</tr>
<tr>
<td>DASS-S</td>
<td>0.36</td>
<td>23.78**</td>
<td>Age</td>
<td>0.08</td>
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<tr>
<td></td>
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<td>BSQ</td>
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<td>DASS-A</td>
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<td>16.96**</td>
<td>Age</td>
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<tr>
<td></td>
<td></td>
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<td>BSQ</td>
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<td></td>
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<td>BSQ</td>
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</tr>
<tr>
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<td>Age</td>
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</tr>
<tr>
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<td></td>
<td></td>
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<td>0.24**</td>
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<tr>
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<td></td>
<td></td>
<td>BSQ</td>
<td>-0.55**</td>
</tr>
<tr>
<td>BPAQ</td>
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<td>0.88</td>
<td>Age</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.06</td>
</tr>
<tr>
<td>Healthy Servings</td>
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<td>0.43</td>
<td>Age</td>
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<td></td>
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<td>-0.01</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Note: BSQ = Body Shape Questionnaire, DASS-A = Depression Anxiety and Stress Scale – Anxiety Subscale, DASS-S = Depression Anxiety and Stress Scale – Stress Subscale, DASS-D = Depression Anxiety and Stress Scale – Depression Subscale, RSES = Rosenberg Self-Esteem Scale, B-PAQ = Baecke Physical Activity Questionnaire, SF-36 PCS = Rand 36-Item Health Survey – Physical Component Summary, and SF-36 MCS = Rand 36-Item Health Survey – Mental Component Summary. *p < 0.05. **p < 0.01.
Table 3
*Multiple Regression Models of Age, BMI, and BSQ as Predictors of Psychosocial and Physical Functioning in Females*

<table>
<thead>
<tr>
<th>DV</th>
<th>Adjusted $R^2$</th>
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<th>IV</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
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<td>10.37**</td>
<td>Age</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.27**</td>
</tr>
<tr>
<td>SF-36 MCS</td>
<td>0.10</td>
<td>10.68**</td>
<td>Age</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.34**</td>
</tr>
<tr>
<td>DASS-S</td>
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<td>7.79**</td>
<td>Age</td>
<td>-0.02</td>
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<td></td>
<td></td>
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<td>BMI</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.29**</td>
</tr>
<tr>
<td>DASS-A</td>
<td>0.05</td>
<td>5.96**</td>
<td>Age</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.25**</td>
</tr>
<tr>
<td>DASS-D</td>
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<td>12.66**</td>
<td>Age</td>
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<tr>
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<td></td>
<td>BMI</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.36**</td>
</tr>
<tr>
<td>RSES</td>
<td>0.21</td>
<td>25.01**</td>
<td>Age</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BMI</td>
<td>0.15*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>-0.49**</td>
</tr>
<tr>
<td>BPAQ</td>
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<td>1.24</td>
<td>Age</td>
<td>0.02</td>
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<td></td>
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<td>BMI</td>
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<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.00</td>
</tr>
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<td>Healthy Servings</td>
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<td>1.94</td>
<td>Age</td>
<td>-0.01</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>BSQ</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Note.* BSQ = Body Shape Questionnaire, DASS-A = Depression Anxiety and Stress Scale – Anxiety Subscale, DASS-S = Depression Anxiety and Stress Scale – Stress Subscale, DASS-D = Depression Anxiety and Stress Scale – Depression Subscale, RSES = Rosenberg Self-Esteem Scale, B-PAQ = Baecke Physical Activity Questionnaire, SF-36 PCS = Rand 36-Item Health Survey – Physical Component Summary, and SF-36 MCS = Rand 36-Item Health Survey – Mental Component Summary.

* *p < 0.05. ** *p < 0.01.
Path Analysis

A path analysis was conducted using a subset of the data, those participants with BMIs at or greater than 23 (n = 159). AMOS version 18.0 was used to fit the model to the data separately by gender (male n = 66 female n = 93). Model parameters were estimated through maximum likelihood estimation and descriptive measures of goodness of fit, including the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). Variables of interest were BMI, Body Image Dissatisfaction (as indicated by BSQ scores), and Physical Functioning (as indicated by the SF-36 PCS). Additionally, the study measures related to psychosocial functioning (the SF-36 MCS, the DASS-D, the DASS-A, the DASS-S, and the RSES) were combined into an aggregate measure of Psychosocial Functioning. In order to do so, the measures were first transformed to be on the same scale, so each measure would carry equal weight in the aggregate measure. Model 1.0 (Figure 2) specified BMI as a predictor of Body Image Dissatisfaction, Physical Functioning, and Psychosocial Functioning, and Body Image Dissatisfaction as a predictor of Physical Functioning and Psychosocial Functioning. Descriptive fit statistics indicated that the model was a poor fit for the data (TLI = -0.29, CFI = 0.79, RMSEA = 0.31 [90% C.I. 0.22-0.41]). Parameter estimates indicated that in males, the BMI to Body Image Dissatisfaction and the BMI to Psychosocial Functioning paths were non-significant, and in females, the BMI to Body Image Dissatisfaction, BMI to Psychosocial Functioning, and BMI to Physical
Functioning paths were non-significant.

Figure 2. Model 1.0 BMI and Body Image Dissatisfaction as Predictors of Physical and Psychosocial Functioning. Body Image Dissatisfaction is indicated by BSQ scores, Physical Functioning by SF-36 PCS scores, and Psychosocial Functioning aggregately by DASS-A, DASS-S, DASS-D, RSES, and SF-36 MCS scores. Error terms for Physical Functioning, Body Image Dissatisfaction, and Psychosocial Functioning are also included (e_phys, e_bid, and e_psy, respectively).

Figure 3. Model 1.0 parameter estimates in men at or above a BMI of 23 kg/m².
When looking across the BMI spectrum, some clear patterns emerged. Higher body image dissatisfaction (based on BSQ scores) was consistently associated with poorer physical and psychological functioning. On the other hand, although higher BMI was modestly associated with poorer physical functioning, no significant associations were found between BMI and variables related to psychological functioning. Similarly, regression analyses found higher body image dissatisfaction to be a significant predictor of physical and psychosocial functioning variables. Likewise, BMI did not emerge as a significant predictor of any psychosocial functioning variables. Importantly, despite the significant negative correlation found between BMI and physical functioning, BMI was not a significant predictor of physical functioning when body image dissatisfaction was also tested as a predictor. This finding lends some support to the proposed mediating role of body image dissatisfaction in the association between increased BMI and decreased physical functioning.
On the other hand, the path analysis failed to find support for the proposed mediational model. There are a few factors that may have contributed to the lack of fit. One is that important factors likely were not included in the model. This is suggested in particular by the multiple regression models. Despite providing striking results, they did not account for a very large amount of the variance seen in the physical and psychosocial functioning variables (ranging from 5% to 36%). For example, as discussed in the introduction, factors such as ethnicity and culture can impact body norms and health outcomes. Due to a small sample size, additional parameters could not be included in the path analysis. In addition, the path analysis was conducted only on a subset of the sample. When looking only at participants with BMIs at or greater than 23 kg/m², BMI was not significantly associated with body image dissatisfaction. In order for a mediational relationship to exist, the independent variable and the dependent variable must be associated (Baron & Kenny, 1986). That no significant association was found between BMI and body image dissatisfaction in this heavier population is interesting. This differs from the more common finding that in unselected samples, BMI and body image dissatisfaction are linked (Sarwer et al., 2005).

**Gender**

Generally, male and female participants showed the same pattern of results. However, some statistically significant differences in the strength of associations emerged. In men, body image dissatisfaction was more strongly correlated with poorer physical functioning than in women. Similarly, body image dissatisfaction was more strongly correlated with symptoms of depression, anxiety, and stress in men than in women, although men and women did not differ significantly in the magnitude of their
correlations between body image dissatisfaction and self-esteem or mental health functioning. Women reported higher levels of body image dissatisfaction than men, as commonly reported in the literature (Sondhaus, Kurtz, & Strube, 2001). Arguably, in Western cultures, there is a degree of “normative discontent” in women regarding their bodies (Grabe & Hyde, 2006). (It may be that it is more abnormal for men to express elevated body image dissatisfaction and thus that expression is more strongly related to psychopathology. The DASS measures psychopathology more directly than the SF-36 MCS or the RSES, which may explain why there is a significant gender difference in the magnitude of correlations between body image and DASS scores but not in the magnitude of correlations between body image and SF-36 MCS or RSES scores. Men who reported higher body image dissatisfaction also reported more physical functioning impairment. It may be that body image is more closely linked to physical functioning in men than in women.

**Health Behaviors**

Indicators of health behaviors were also measured, but were not found to correlate with either BMI or body image dissatisfaction, with the exception that, in women, higher body image dissatisfaction was modestly associated with more consumption of healthy foods ($r = 0.14$). Past studies have found associations between body image dissatisfaction and increased dieting (C. N. Markey & Markey, 2005; Putterman & Linden, 2004). The unvalidated 3-item measure of healthy food consumption used in this study may not have properly assessed the construct. On the other hand, the B-PAQ has demonstrated good convergent validity with physical activity (Philippaerts et al., 2007), so it can be stated more confidently, in this sample, self-reported physical activity was
not associated with BMI or body image dissatisfaction. A potential confounding issue is that muscle is denser than fat, the result of which is people with high muscle mass may have high BMIs without increased fat deposits or health risks. The increased muscle mass in those who are more physically active may suppress any negative association between physical activity and BMI due to lower adiposity levels.

**Self Esteem**

Another interesting result was found in the multiple regression analyses in which age, BMI, and BSQ were entered as predictors of self-esteem. As with the other psychosocial functioning variables, the Pearson product-moment correlations did not show a significant association between BMI and self-esteem. However, in multiple regression analyses, higher BMI emerged as a significant predictor of higher self-esteem scores in both men and women (\( \beta = 0.25 \) and 0.15, respectively). One possibility is that there is naturally a small positive correlation between increased BMI and increased self-esteem, but it is suppressed by the correlation between increased BMI and increased body image dissatisfaction.

**Limitations**

This study is subject to a number of limitations. This study uses cross-sectional data collected at a single time-point without controls. Therefore, all of the analyses are essentially correlational with no information about precedence, which precludes establishing directionality. One concern is the effect of variables that were not measured in this study; for example, an unmeasured variable could influence two or more measured variables which would otherwise be independent. Some examples are obesity stigma experiences, socio-economic status, and mental health history. One notable possibility is
that response style to self-report questionnaires may be an influential unmeasured variable. Most of the variables of interest including body image dissatisfaction, physical functioning, mental health functioning, depression, anxiety, stress, and self-esteem, were measured through self-report questionnaires. Response style could plausibly affect all of these measures in a similar way, artificially increasing their covariance. On the other hand, BMI was calculated based on self-reported height and weight, more objective items that could foreseeably be less impacted by a particular response style.

Further concerns exist with the self-report nature of this study. Of particular concern is misreporting of height and weight. When gathered through self-report means, it is likely that men and women overestimate height and underestimate weight, although less so on written questionnaires than on telephone interviews (S. C. Gorber, Tremblay, Moher, & Gorber, 2007). Although reporting biases and misunderstanding of questions can impact the accuracy of self-report measures of psychosocial functioning, a large degree of the factors involved in these constructs are only measurable through some form of self-report. External measures of health are more readily available, such as biochemical measures including blood pressure and cholesterol levels that individuals may not be aware of themselves.

Additionally, the sample used in this study consisted primarily of undergraduate students; all participants were enrolled in an undergraduate psychology course, and 91% of participants had not yet completed a 4-year degree. This population differs from the broader population in age, socioeconomic status, BMI, physical health, and psychosocial functioning. Thus, the generalizability of findings based on this sample may be limited. For example, it is very plausible that the finding of only a small association between BMI
and physical functioning impairment would not hold in older adults. However, it is worth noting that Muennig’s (2008) analysis of a large, population-based health study dataset provides support that these same patterns can also be found in the broader population.

**Implications**

This study adds to an incipient literature suggesting that body image dissatisfaction may play an important role in health outcomes. This has a number of implications. First, body image dissatisfaction may be an important intervention target for people suffering from or at risk of impaired health functioning. That weight loss itself might not be essential to health improvements is suggested by non-dieting interventions that emphasize healthy behaviors and body acceptance. These programs have been found to result in improved health indicators such as blood pressure even though participants maintain their baseline weights (Bacon, Stern, Van Loan, & Keim, 2005; Katzer et al., 2008).

The fact that Bacon and colleagues’ (2005) and Katzer and colleagues’ (2008) non-dieting interventions resulted in health improvements without weight changes lends further support that additional factors beyond adiposity should be considered in health promotion effort. Indeed, it is worth considering that the emphasis on weight itself could produce harmful effects. Weight bias is prevalent and is perceived as more socially acceptable than other forms of prejudice (Puhl & Heuer, 2009). The health consequences of obesity provide one justification of negative views of and actions towards overweight and obese individuals. Essentially, the idea is that fat is unhealthy, so overweight and obese people should not be helped to feel comfortable with their bodies. Well-meaning health professionals and researchers also seek ways to alert those who are overweight or
obese the their weight problems, and public health campaigns have used very negatively charged imagery of obesity in attempts to foster positive health behaviors. This research indicates that such campaigns and programs may in fact contribute to the negative health outcomes they aim to ameliorate.

Although preliminary, these findings highlight the complexity of the relationship between adiposity and health impairment and argue for the importance of broadening health models to incorporate psychosocial factors. One avenue is to explore the mechanisms through which body image dissatisfaction might impact health. Body image dissatisfaction may contribute to unhealthy dieting behaviors (C. N. Markey & Markey, 2005; Putterman & Linden, 2004) and reduced physical activity (Markland, 2009). Additionally, body image dissatisfaction is linked to increased stress (Johnson & Wardle, 2005), which has been demonstrated to directly affect disease processes (Cohen et al., 2007).

It is worth noting that rather than mediating the relationship between adiposity and health impairment, body image dissatisfaction could instead serve as a marker for important health risk factors. For example, body image dissatisfaction may be more likely to manifest in the context of cultural weight bias. Weight bias has been shown to result in social and economic discrimination against people who are obese (Puhl & Heuer, 2009). Economic distress may impact access to health care, and social isolation is found to be a major contributor to disease (Cohen et al., 2007; Kiecolt-Glaser et al., 2002). Clearly, more research is needed to tease apart the effects of these myriad factors.
Appendix A: Demographics Questionnaire

1. Age:
2. Gender:  Male  Female
3. Sexual Orientation:  Heterosexual  Homosexual  Bisexual
4. Please list all of the ethnic groups that you belong to (i.e. African-American, Filipino, Hawaiian, Native American, Caucasian, Hispanic, Chinese, Japanese, etc):

5. Do you strongly identify with any of the ethnic groups that you listed above?  Yes  No
   If yes, which groups do you strongly identify with?

6. Education Level:  Some high school  High school diploma/GED  Some college
   College degree (4yr)  Some graduate school
   Advanced degree
7. What is your current weight? (Even if you aren't very sure, please provide the best estimation that you can.)  Please specify pounds or kilograms.
8. What is your current height? (Even if you aren't very sure, please provide the best estimation that you can.)  Please specify feet or centimeters.
9. Over the past six (6) months, what has happened to your weight?
   Decreased (Lost Weight)  Stayed approximately the same  Increased (Gained Weight)
10. Please circle the image that best represents your body shape:

11. How would you describe your current weight?  Underweight  Normal  Overweight  Obese
12. How do you feel about your current weight?
Very Unsatisfied  Unsatisfied  Somewhat Unsatisfied  Somewhat Satisfied
Satisfied  Very Satisfied
13. What is the weight that you think you would be most satisfied at? Please specify pounds or kilograms.

14. How many times have you been on a diet with the intention to lose weight/slim down?

15. Are you on a diet now?  Yes  No
16. How many times in your lifetime have you lost at least twenty pounds and gained it back again?
Never  Once or twice  Three or four times  Five times or more
17. What is your highest lifetime weight (not due to pregnancy)? Please specify pounds or kilograms.

18. What is the lowest weight, since you turned 21, that you have maintained for at least a year (not due to illness)? Please specify pounds or kilograms. Leave blank if you are 21 years old or younger.

19. On average, how frequently do you weigh yourself (or get weighed by someone else)?
Never  Less than once a year  Once or twice a year  3-5 times per year (every few months)  6-11 times per year (every one or two months)  1-3 times per month  1-2 times per week  3-7 times per week  More than once a day
20. In comparison to people in my family, my weight is:  Much lower than average  Lower than average  About average  Higher than average  Much higher than average
21. In comparison to the people in my life (coworkers, neighbors, friends, church members, etc), my weight is:
Much lower than average  Lower than average  About average  Higher than average  Much higher than average
The following questions ask you about how much you typically eat of various foods.
22. I eat fruit:
Less than once a week  1-3 times per week  4-6 times per week  Usually everyday
23. On a typical day, I will eat about servings of fruit. A serving of fruit is 1 medium sized fruit (the size of a tennis ball), 1/2 cup of chopped fruit (the size of a light bulb) or 3/4 cup of fruit juice (the size of a small Styrofoam cup).
24. I eat vegetables:
   Less than once a week       1-3 times per week       4-6 times per week       Usually everyday
25. On a typical day, I will eat about servings of vegetables. *A serving of vegetables is 1/2 cup of cooked or raw vegetables (the size of a scoop of ice cream), 3/4 cup of vegetable juice (the size of a small Styrofoam cup) or 1 cup of raw leafy vegetables (the size of a baseball).*
26. I eat whole grains:
   Less than once a week       1-3 times per week       4-6 times per week       Usually everyday
27. On a typical day, I will eat about servings of whole grains. *A serving of whole grains is 1 slice of whole wheat bread (the size of an audio cassette tape), 1/2 cup cooked cereal, brown rice (the size of a tennis ball), or whole wheat pasta, or 1 ounce of cold whole grain cereal.*
28. I typically eat sweets and/or snack food:
   Less than once a week       1-3 times per week       4-6 times per week       Usually everyday
29. On a typical day, I will eat:
   No sweets or snack food
   A small taste of a sweet or snack food
   One sweet or snack food (a small bag of candy, piece of cake, scoop of ice cream, small bag of chips, etc)
   2-3 sweets and/or snack food items
   4-5 sweets and/or snack food items
   6 or more sweets and/or snack food items

How well do you agree with the following statements?
30. At this time, controlling my weight is one of my top priorities.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
31. At this time, eating healthfully is one of my top priorities.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
32. At this time, exercising regularly is one of my top priorities.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
33. At this time, being physically attractive is one of my top priorities.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
34. At this time, taking care of my physical health is one of my top priorities.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
35. I am physically attractive to others.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree
36. I am physically healthy.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree

37. People who don't control their weight are not physically healthy.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree

38. People who don't control their weight are not physically attractive.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree

39. I think that it is important for people of my sex to be muscular.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree

40. I have a muscular body.
   Strongly disagree       Disagree       Somewhat disagree       Somewhat agree       Agree
   Strongly agree

41. I would like to be:
   Much less muscular than I am now
   Less muscular than I am now
   At the same level of muscularity as I am now
   More muscular than I am now
   Much more muscular than I am now
Appendix B: Body Shape Questionnaire (BSQ)

*We would like to know how you have been feeling about your appearance over the past four weeks. Please read each question and choose the appropriate answer. Please answer all of the questions.*

1. Has feeling bored made you brood about your shape?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

2. Have you thought that your thighs, hips or bottom are too large for the rest of you?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

3. Have you worried about your flesh being not firm enough?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

4. Have you felt so bad about your shape that you have cried?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

5. Have you avoided running because your flesh might wobble?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

6. Has being with thin men or women made you feel self-conscious about your shape?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

7. Have you worried about your thighs spreading out when sitting down?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

8. Has eating even a small amount of food made you feel fat?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

9. Have you avoided wearing clothes which make you particularly aware of the shape of your body?
   - Never
   - Rarely
   - Sometimes
   - Often
   - Very Often
   - Always

10. Has eating sweets, cakes or other high calorie goods made you feel fat?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

11. Have you felt ashamed of your body?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

12. Has worrying about your shape made you diet?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

13. Have you felt happiest about your shape when your stomach has been empty (e.g., in the morning)?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

14. Have you felt that it is not fair that other men or women are thinner than you?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

15. Have you worried about your flesh being dimply?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always

16. Has worrying about your shape made you feel you ought to exercise?
    - Never
    - Rarely
    - Sometimes
    - Often
    - Very Often
    - Always
Appendix C: Rand 36-Item Health Survey – Version 1.0 (SF-36)

1. In general, how would you rate your health?
   Excellent       Very Good       Good       Fair       Poor

2. **Compared to one year ago**, how would you rate your health in general **now**?
   Much better       Somewhat better       About the same       Somewhat worse       Much worse

   *The following items are about activities you might do during a typical day. Does your health now limit you in these activities?*

3. **Vigorous activities** (such as running, lifting heavy objects, participating in strenuous sports)
   Yes, limited a lot       Yes, limited a little       No, not limited at all

4. **Moderate activities** (such as moving a table, pushing a vacuum cleaner, bowling or playing golf)
   Yes, limited a lot       Yes, limited a little       No, not limited at all

5. Lifting or carrying groceries
   Yes, limited a lot       Yes, limited a little       No, not limited at all

6. Climbing **several** flights of stairs
   Yes, limited a lot       Yes, limited a little       No, not limited at all

7. Climbing **one** flight of stairs
   Yes, limited a lot       Yes, limited a little       No, not limited at all

8. Bending, kneeling or stooping
   Yes, limited a lot       Yes, limited a little       No, not limited at all

9. Walking **more than a mile**
   Yes, limited a lot       Yes, limited a little       No, not limited at all

10. Walking **several blocks**
    Yes, limited a lot       Yes, limited a little       No, not limited at all

11. Walking **one block**
    Yes, limited a lot       Yes, limited a little       No, not limited at all

12. Bathing or dressing yourself
    Yes, limited a lot       Yes, limited a little       No, not limited at all

   *During the past 4 weeks*, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

13. Cut down the amount of time you spent on work or other activities
    Yes       No

14. **Accomplished less** than you would like
    Yes       No

15. Were limited in the **kind** of work or other activities
    Yes       No

    Had **difficulty** performing the work or other activities (for example, took extra effort)
    Yes       No

   *During the past 4 weeks*, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

17. Cut down the **amount of time** you spent on work or other activities
    Yes       No

18. **Accomplished less** than you would like
    Yes       No

19. Didn't do work or other activities as **carefully** as usual
    Yes       No
20. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups?
   Not at all       Slightly       Moderately       Quite a bit       A lot       Extremely

21. How much bodily pain have you had during the past 4 weeks?
   None       Very mild       Mild       Moderate       Severe       Very severe

22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
   Not at all       Slightly       Moderately       Quite a bit       A lot       Extremely

These questions are about how you feel and how things have been with you during the last 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much during the past 4 weeks...

23. ...did you feel full of pep?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

24. ...have you been a very nervous person?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

25. ...have you felt so down in the dumps that nothing could cheer you up?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

26. ...have you felt calm and peaceful?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

27. ...did you have a lot of energy?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

28. ...have you felt downhearted and blue?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

29. ...did you feel worn out?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

30. ...have you been a happy person?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

31. ...did you feel tired?
   All of the time    Most of the time    A good bit of the time    Some of the time    A little of the time    None of the time

32. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc)?
   All of the time    Most of the time    A good bit of the time    Some of the time    A
little of the time  None of the time

_**How TRUE or FALSE is each of the following statements for you?**_

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>33. I seem to get sick a little easier than other people.</td>
<td>Definitely true</td>
<td>Mostly true</td>
<td>Don't know</td>
<td>Mostly false</td>
</tr>
<tr>
<td>34. I am as healthy as anybody I know.</td>
<td>Definitely true</td>
<td>Mostly true</td>
<td>Don't know</td>
<td>Mostly false</td>
</tr>
<tr>
<td>35. I expect my health to get worse.</td>
<td>Definitely true</td>
<td>Mostly true</td>
<td>Don't know</td>
<td>Mostly false</td>
</tr>
<tr>
<td>36. My health is excellent.</td>
<td>Definitely true</td>
<td>Mostly true</td>
<td>Don't know</td>
<td>Mostly false</td>
</tr>
</tbody>
</table>
Appendix D: Depression Anxiety Stress Scale - 21 item version (DASS-21)

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
- 0 - Did not apply to me at all
- 1 - Applied to me at some degree or some of the time
- 2 - Applied to me to a considerable degree or a good part of the time
- 3 - Applied to me very much or most of the time

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I found it hard to wind down.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>I was aware of dryness in my mouth.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>I couldn't seem to experience any positive feeling at all.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in absence of physical exertion).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>I found it difficult to work up the initiative to do things.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>I tended to overreact to situations.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>7</td>
<td>I experienced trembling (e.g., in the hands).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>I felt that I was using a lot of nervous energy.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>I was worried about the situations in which I might panic and make a fool of myself.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>I felt that I had nothing to look forward to.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>I found myself getting agitated.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>I found it difficult to relax.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>I felt down-hearted and blue.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>I was intolerant of anything that kept me from getting on with what I was doing.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>I felt I was close to panic.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>I was unable to become enthusiastic about anything.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>I felt I wasn't worth much as a person.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>I felt that I was rather touchy.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>I felt scared without any good reason.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>I felt that life was meaningless.</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix E: Baecke Physical Activity Questionnaire (Baecke PAQ)

1. What is your main occupation?

2. At work/school I sit: Never Seldom Sometimes Often Always

3. At work/school I stand: Never Seldom Sometimes Often Always

4. At work/school I walk: Never Seldom Sometimes Often Always

5. At work/school I lift heavy loads: Never Seldom Sometimes Often Always

6. After work/school I am tired: Never Seldom Sometimes Often Always

7. At work/school I sweat: Never Seldom Sometimes Often Always

8. In comparison with others of my own age, I think my work/school is physically:
   Much heavier Heavier As heavy Lighter Much lighter

9. Do you play a sport? yes no
   If yes, which sport do you play most frequently?
   - How many hours a week? < 1 1-2 2-3 3-4 >4
   - How many months per year? < 1 1-3 4-6 7-9 >9
   If you play a second sport, please specify:
   - How many hours a week? < 1 1-2 2-3 3-4 >4
   - How many months per year? < 1 1-3 4-6 7-9 >9

10. In comparison with others of my own age, I think my physical activity leisure time is:
    Much more More As much Less Much less

11. During leisure time I sweat: Never Seldom Sometimes Often Always

12. During leisure time I play sport: Never Seldom Sometimes Often Always

13. During leisure time I watch TV: Never Seldom Sometimes Often Always

14. During leisure time I walk: Never Seldom Sometimes Often Always

15. During leisure time I cycle: Never Seldom Sometimes Often Always

16. How many minutes a day do you walk and/or cycle to and from:
    - Work: < 5 5-15 30-45 >45
    - School: < 5 5-15 30-45 >45
    - Shopping: < 5 5-15 30-45 >45
Appendix F

Rosenberg Self-Esteem Scale (RSES)

Below is a list of statements dealing with your general feelings about yourself. Choose whether you strongly agree, agree, disagree or strongly disagree.

1. I feel that I'm a person of worth, at least on an equal plane with others.
   Strongly Agree    Agree    Disagree    Strongly Disagree

2. I feel that I have a number of good qualities.
   Strongly Agree    Agree    Disagree    Strongly Disagree

3. All in all, I am inclined to feel that I am a failure.
   Strongly Agree    Agree    Disagree    Strongly Disagree

4. I am able to do things as well as most other people.
   Strongly Agree    Agree    Disagree    Strongly Disagree

5. I feel I do not have much to be proud of.
   Strongly Agree    Agree    Disagree    Strongly Disagree

6. I take a positive attitude toward myself.
   Strongly Agree    Agree    Disagree    Strongly Disagree

7. On the whole, I am satisfied with myself.
   Strongly Agree    Agree    Disagree    Strongly Disagree

8. I wish I could have more respect for myself.
   Strongly Agree    Agree    Disagree    Strongly Disagree

9. I certainly feel useless at times.
   Strongly Agree    Agree    Disagree    Strongly Disagree

10. At times I think I am no good at all.
    Strongly Agree    Agree    Disagree    Strongly Disagree
References


Friedman, K. E., Reichmann, S. K., Costanzo, P. R., & Musante, G. J. (2002). Body image partially mediates the relationship between obesity and psychological distress. *Obesity, 10*(1), 33-41. doi:10.1038/oby.2002.5


