Abstract

Exercise effects on physical activity level, self-perception, and quality of life of sedentary children, the interaction of BMI, and the association between moderate to vigorous physical activity and psychological variables.

By Kathryn E. Wilson

April 12th, 2010

Chair: Dr. Tom Raedeke

DEPARTMENT OF EXERCISE AND SPORT SCIENCE

The purposes of this study were to (a) examine the relationship of physical activity with global self-esteem (GSE), physical self-worth (PSW), physical self-perceptions, and health related quality of life (HRQOL), and to (b) evaluate the effects of a 16 week exercise intervention on self-perception and quality of life related outcomes in sedentary youth. A sample, $N = 40$, of sedentary children 8-11 ($M = 9.55$) years of age, including 22 males and 18 females, 23 obese and 17 healthy weight participants, were assessed using the Children and Youth Physical Self-Perception Profile (CY-PSPP), Children's Attraction to Physical Activity scale and the Pediatric Quality of Life Inventory (PedsQL 4.0), pre- and post test. Accelerometers measured PA level pre- and post-test as well. Participants were randomly assigned to an exercise intervention ($n = 26$) and control ($n = 14$) condition. Exercise participants were required to exercise for one hour, supervised, at least 3 days/week over a 16-week period. Children exercised one-on-one or in small groups. Participants were required to average $\geq$ 140 bpm per activity bout as measured by heart rate monitors. Activity options were limited to equipment and space available. The control group consisted of a no treatment condition. Pearson's Correlation demonstrated no significant association between physical activity and any of the psychological variables. Independent samples T-tests demonstrated similarity between the groups for most variables at baseline, and for all variables at follow-up; obese children were found to have impaired perceived body attractiveness and HRQOL physical functioning when compared to healthy weight participants. 2 x 2 Repeated Measures ANOVAs demonstrated no effect of the exercise intervention on any of the outcome variables for healthy weight or obese participants. Overall, the current investigation implies that moderate to vigorous physical activity level may lack association with GSE, PSW, physical self-perceptions and HRQOL among inactive 8-11 year olds. Additionally, basic exercise interventions may be insufficient to increase moderate to vigorous physical activity level, and improve GSE, PSW, physical self-perceptions, and HRQOL among inactive healthy weight or obese children.

Exercise effects on physical activity level, self-perceptions, and quality of life of sedentary children, the interaction of BMI, and the association between moderate to vigorous physical activity and psychological variables.

A Thesis

Presented To

The Faculty of the Department of Exercise and Sport Science

East Carolina University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Exercise and Sport Science

by

Kathryn E. Wilson

April 12th, 2010

EXERCISE EFFECTS ON PHYSICAL ACTIVITY LEVEL, SELF-PERCEPTION, AND QUALITY OF LIFE OF SEDENTARY CHILDREN, THE INTERACTION OF BMI, AND THE ASSOCIATION BETWEEN MODERATE TO VIGOROUS PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES

by

Kathryn E. Wilson

APPROVED BY:

DIRECTOR OF THESIS:____

Tom Raedeke, PhD

COMMITTEE MEMBER:____

Bob Hickner, PhD

COMMITTEE MEMBER:____

Katrina DuBose, PhD

COMMITTEE MEMBER:____

Janet Funderburk, PhD

CHAIR OF THE DEPARTMENT OF EXERCISE AND SPORT SCIENCE:

____

Stacy Altman, PhD

DEAN OF THE GRADUATE SCHOOL:

____

Paul J. Gemperline, PhD

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Chapter 1: Introduction

In recent years, the evidence supporting physical inactivity and obesity as major contributors to overall health, performance capacity, and quality of life, has been rapidly growing (Blair & Brodney, 1999; Brown et al., 2003; Brown et al., 2004; Dietz, 1998; Lee & Skerrett, 2001; Pinhas-Hamiel, Singer, Pilpel, Fradkin, Modan, & Reichman, 2006). Relative to such incites, a serious health threat is spreading worldwide, with an undeniable link to physical activity levels. Populations across the globe are facing heavy consequences due to obesity.

The Centers for Disease Control (CDC) defines obesity as the accumulation of excessive body fat and is often defined through body mass index (BMI). BMI accurately reflects the proportion of excess body fat and correlates with markers of secondary complications due to obesity (Barlow & Dietz, 1998). For adults, obesity is often referred to as a BMI $\geq$ 30 kg/m^2, and overweight is defined as a BMI between 25 and 29.9 kg/m^2 (CDC, 2009). For children and adolescents, simple obesity definitions are based on BMI percentile rankings appropriate for age and gender termed BMI-for-age. According to this classification, obese is defined as a BMI-for-age $\geq$ 95th percentile and overweight is defined as between the 85th and 95th percentile (CDC, 2009). These measures are referred to as BMI-for-age and have been validated as indicative of body fatness and health risk among children (Freedman & Sherry, 2009).

Obesity levels have been rising over the past few decades, and continue to rise. Once considered a problem for only high-income countries, the obesity epidemic is spreading and has dramatically increased in low- and middle-income countries, particularly in urban settings (World Health Organization [WHO], 2006). It has been projected that by 2015, 700 million adults will be obese (WHO, 2006). As of 2005, estimates of obesity in the US have skyrocketed to include 41.8% of females and 36.5% of males aged 15-100 years. Estimates proposed by the

WHO (2006) state that by 2015 those percentages will have increased to 54.3% and 51.7% respectively.

The consequences of obesity can be defined in terms of human suffering, as well as a substantial economic burden, evident with increased sick leave, health insurance cost, doctor visits and hospital stays (Holm, Spector, Hicks, Carlson, & Lanuza, 2001). Childhood obesity takes its toll on the overall health of the individuals, and also imposes a heavy national burden. In 2002, obesity-associated annual hospital costs showed that the cost of childhood obesity in such terms had tripled in 20 years from $35 million in 1979 to 1981, to $127 million in 1997 to 1999 (Wang & Dietz, 2002). These expenses are a reflection of the physical health consequences imposed on individuals suffering from obesity. Despite these overwhelming estimates, it has been observed that only a small percentage of individuals aged 14 to 61 who perceive themselves as overweight actually seek medical attention for weight loss (Stewart & Brook, 1983). It would seem that being overweight is not enough to cause individuals to consult a medical professional. This is particularly alarming when considering the fact that children are dependent on their care-givers to provide them with the proper care. If a child suffered from an ailment, the care-giver should seek the proper medical attention. This may not be the case with obesity among youth, which in the recent past has grown to epidemic proportions (Ogden, Flegal, Carol, & Johnson, 2002).

Obese children are faced with many physical health threats. Such problems include cardiovascular disease, growth abnormalities, glucose intolerance, hepatic, endocrine and pulmonary problems, and orthopedic, gastroenterological, and neurological difficulties (Dietz, 1998; Freedman, Dietz, Srinicasan & Berenson, 1999; Strauss, 1999). Obesity in childhood increases the risk for adolescent obesity, which has been found to be a stronger predictor of overall mortality than adult obesity (Strauss, 1999).

In addition to physical complications, the health consequences of obesity tracking from childhood into adolescence and adulthood are evident in the social context (Dietz, 1998). Childhood obesity has been shown to be one of the least socially acceptable and stigmatizing categories for an individual to experience (Schwimmer, Burwinkle, & Varni, 2003). The tendency to judge an individual in a negative or discriminative way because he or she is overweight, defined as obesity bias, is ubiquitous in US society (Puhl & Brownell, 2001). Regardless to whether it is explicit or implicit, such bias serves as a strong barrier to the adoption of a healthy lifestyle, and cultivates the tendency of the obese child to choose isolated, sedentary activities over sports or other physical activities (Li & Rukavina, 2007; Sisson, Church, Martin, Tudor-Locke, Smith, Bouchard, et al., 2009). Such sedentary lifestyle contributes to the presence of childhood obesity (Goran, Reynolds, & Lindquist, 1999) which greatly increases the chance of obesity, and its deleterious effects on health, persisting through adulthood (Guo, Roche, Chumlea, Gardner, & Siervogel 1994; Trzensniewski, Moffitt, Poulton, Donnellan, Robins, & Caspi, 2006). It has been shown that obese adults are more likely to complete fewer years of education, have a lower family income, higher poverty rates, and lower marriage rates than that of their lean counterparts (Zametkin, Zoon, Klein, & Munson, 2004).

One must consider the impact of physical ailments and social stigma on the mental health of a physically and socially developing individual, such as a child. Reviews confirm that there is evidence of impaired mental health among obese youth, compared to healthy weight youth (Reilly, Methven, McDowell, Hacking, Alexander, Stewart, et al., 2003; Zametkin et al., 2004), but the findings are inconsistent (Zametkin et al. 2004). Low self-esteem and behavioral problems show a particularly high prevalence in obese children (Reilly et al., 2003). These effects were magnified in children whose parents exhibited mental health issues (Strauss, 2000). The link between obesity and low self-esteem is important because of the link between self-esteem and motivation, as well as additional health consequences resulting from low self-esteem. It has been shown that low self-esteem in childhood is a strong predictor of poor academic achievement, poor classroom participation, poor attainment of social skills, low participation in extracurricular activities, the inability to attain leadership status, limited economic prospect during adulthood, aggressive behavior, substance abuse, development of eating disorders, teenage pregnancy, marital discord, criminal behavior, social fears and phobias, suicide attempts, depression, poor appetite, sleeplessness, and headaches (Sonstroem, 1984; Trzesniewske, Donnellan, & Robins, 2003). Self-esteem has also been shown to be a mediator between BMI and Health Related Quality of Life (HRQOL) (Wallander, Wendell, Grunbaum, Franklin, Harrison, Kelder et al., 2009).

All health consequences of obesity have the potential to play a major role in decreasing ones quality of life. HRQOL is a multidimensional concept, summarized as the satisfaction one has with his/her life, with specific regard to perception of overall health status, and the limitations of health related functioning, independent of socioeconomic status (Moscatiello, Manini, Marzocchi, & Marchesini, 2007). Studies examining adult populations report an inverse relationship between BMI and HRQOL among varying levels of obesity (Fontaine & Barofsky, 2001; Fontaine, Cheskin, & Barofsky, 1996). Studies exploring the relationship between BMI and HRQOL in children and adolescents are limited. However, an inverse relationship between weight status and HRQOL in children and adolescents has been observed (Pinhas-Hamiel, Singer, Pilpel, Fradkin, Modan, & Reichman, 2006; Tsiros, Olds, Buckley, Grimshaw, Brennan, Walkley et al., 2009).

According to recent analyses, progress in the battle against childhood obesity is being made. Prevalence of overweight and obesity among youth is stabilizing (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010) which differs from the trend of increase seen over the past few decades (Ogden et al., 2002). Although this may bring a glimmer of relief to the eyes of health care professionals, it is evident that there is still cause for continued intervention to attenuate current levels of overweight and prevent such extremes in the future. Treatment and prevention are obviously needed. Interventions must be designed to address the complex nature of health consequences associated with obesity.

Physical activity is important in the treatment, reduction, and prevention of obesity (Barlow & Dietz, 1999) in clinical and nonclinical populations (Taylor, Sallis, & Needle, 1985). Increasing levels of regular physical activity can have a major impact on current and future levels of childhood obesity, which could positively alter the health status of future generations. An increase in physical activity not only addresses the issue of energy expenditure, it has been confirmed to posit great psychological benefit (Morgan, 1976). Exercise has been used to reduce anxiety (Johnsgard, 1989) and treat depression (Greist, Klein, Eischens, Faris, Gurman, & Morgan, 1979). It has also been observed to have a positive effect on self-esteem (Ekeland, Heian, Hagen, Abbott, & Nordheim, 2008; Sonstroem, 1984) as well as physical self-worth (PSW) (Fox, 2000). Physical activity has been linked to reduced cardiovascular reactivity to psychosocial stress in Type A individuals (Lox, Martin, & Petruzzello, 2003), improved mood state, self-concept, work behavior, and cognitive functioning (Folkins & Sime, 1981). Moreover, physical activity levels have been linked to participation in preventative behaviors, reduction of risk-taking behaviors, healthy dietary habits (Blair, Jacobs, & Powell, 1985), and improved academic performance (Tomporowski, Davis, Miller, & Naglieri, 2008). Such association suggests a large role for physical activity in overall development of physical, mental, and social health of children and adolescents (Goran et al., 1999). Interventions utilizing an increase in physical activity can potentially result in benefits beyond the goal of weight regulation, to include positive psychological and psychosocial impact.

Purpose

This study examined whether average minutes of moderate to vigorous activity (MVPA) at baseline correlated with global self esteem, as well as PSW and HRQOL subscales among sedentary 8-11 year olds. This study also examined whether participation in a structured exercise program, 16 weeks in duration, resulted in improved self-perceptions, HRQOL, and increased MVPA. Lastly, this study also evaluated whether healthy weight and obese children showed similar changes in the dependent variables as a result of exercise participation.

Hypotheses

Based on previous literature, it is hypothesized that: 1) Average daily minutes of MVPA will be positively correlated to more positive scores on physical self-perception subscales, HRQOL physical functioning, and HRQOL social functioning. 2) Exercise participation will result in an increase in MVPA. 3) Although global self-esteem (GSE) will not change for either condition, exercise participants will show increased PSW and improvements in physical self-perceptions (i.e. perceived physical condition, perceived physical strength, perceived body attractiveness, and perceived sport competence) compared to those in the control condition. 4) Participants in the exercise condition will show improved HRQOL, especially on subscale for HRQOL physical functioning. 5) Obese children will exhibit lower baseline levels of PSW and perceived body attractiveness than healthy weight children, therefore, 6) obese participants in the exercise group will exhibit greater gains over time in PSW and perceived body attractiveness than the healthy weight participants in the exercise group.

Limitations

Analyses should be interpreted with caution as the groups were not matched for number, gender, BMI status, or race. Additionally, participant history plays a major role in the limitations of this study. Self concept, being derived from all internal and external experiences, is highly susceptible to change from influence outside of the parameters of this study. Every day, the self concept of the participants is likely growing, and changing along with the child's internal and external environments.

It is worth noting that because these children are being recruited continuously, not all participants encountered the same instructors or questionnaire administrators. Because administration of these questionnaires took place over an extended period, and multiple administrators contributed to data collection, efforts were made to confirm the occurrence of questionnaire administration training throughout the study; such attempts resulted in the observation that such training was likely to have not occurred.

Chapter 2: Literature Review

The following literature review will provide the reader with background information regarding physical activity, and BMI, and their relationship with self-esteem, physical self-perceptions, and HRQOL. First the relationship between BMI and physical activity is discussed, followed by the relation of physical activity to demographics such as age, gender and race. An explanation of the construct of self-esteem will be followed by its association with BMI and physical activity. Finally, an explanation of HRQOL and its associations with BMI and physical activity is offered. This section will provide a basis on which to pose the current questions regarding the association of physical activity with GSE, PSW, physical self-perceptions, and HRQOL, and the effect of a 16 week exercise intervention on those psychological variables among sedentary 8-11 year old obese and healthy weight children. Results from this study may aid in the development of interventions using exercise to treat and prevent childhood obesity.

Physical Activity

The use of physical activity as an intervention for overweight and obese youth is logical. Great physical, psychological, and social gain can be derived from participation in regular physical activity (Blair, Jacobs, & Powell, 1985; Ekeland et al., 2008; Folkins & Sime, 1981; Fox, 2000; Goran et al., 1999; Greist et al., 1979; Johnsgard, 1989; Lox et al., 2003; Morgan, 1976; Sonstroem, 1984; Tomporowski et al., 2008).

Body mass index (BMI) has been shown to correlate negatively with physical activity among youth. On average, overweight children participate in 20 minutes less MVPA than their normal weight peers. Physical activity patterns were observed to be similar on weekdays and weekend days for overweight and healthy weight children aged 6 through 10 years (Deforche, De Bourdeaudhuij, D'hondt, & Cardon, 2009). Differences, however, were observed in physical activity intensities achieved, indicating that overweight children accumulated less MVPA than their healthy weight peers. A strong inverse relationship ($p < .0001$) between BMI and physical activity was shown in a study examining girls ranging from 5th grade to 12th grade (Wolf, Gortmaker, Cheung, Gray, Herzog, & Colditz, 1993).

Physical activity levels in youth have been shown to be related to age and gender. Strauss, Rodzilsky, Burack, & Colin (2001) found that before the age of 13, physical activity levels were similar between boys and girls; however, boys were found to be more active than girls thereafter. Additionally, many studies have shown significant decreases in physical activity for both boys and girls during adolescence; this decrease in physical activity is more severe in females than males (Kelder et al., 1994; Strauss et al., 2001; Wolf et al., 1993). According to self-report, adherence with the federal recommendations for activity (USDHHS, 2001) is exhibited in only 57% of male teens and 40% of female teens (Butcher, Sallis, Mayer, & Woodruff, 2008). Even more alarming, a recent study measured MVPA using accelerometers and reported that only 42% of children ages 6-11 years, and 8% of adolescents, ages 12-19 years, participated in the recommended level of physical activity (Troiano, Berrigan, Dodd, Masse, Tilert, & McDowell, 2008). Health behaviors, such as physical activity, have been shown to track from childhood, as early as the sixth grade or prior, through adolescence (Kelder et al., 1994). This lends support to the idea that interventions regarding physical activity, and/or other health behaviors, should begin at an early age.

Conflicting results have been seen regarding youth race and physical activity. Butcher et al. (2008) found no relationship between physical activity and race for female adolescents, but found a significant correlation between race and physical activity among male adolescents. It was reported that non-Hispanic “others” (as indicated by self-report) showed a significantly lower level of physical activity than Hispanic White males; no significance was found among other tested races (Butcher et al., 2008). Wolf et al. (1993) found that among females in grades 5 through 12, Asians and Hispanics reported significantly less activity than other racial groups.

Interventional efforts should undoubtedly, yet nonexclusively, be focused on improving level of physical activity. Given that race, age, and gender differences exist, those variables should be considered when designing interventions for specific groups or clients. Additionally, it may be beneficial to focus on correlates of physical activity that may be influenced in attempts to increase habitual physical activity. Psychological correlates of physical activity provide appropriate targets for physical activity interventions among overweight youth. One strategy for intervention design would be to focus on improving characteristics that have been shown to correlate negatively with BMI, and positively with physical activity level. By focusing on psychological correlates of physical activity, in addition to physical activity itself, there may be a greater chance that interventions will result in successful adoption of a physically active lifestyle.

The following sections aim to provide a review of self-esteem and HRQOL, and their relation to physical activity. Exploration of such relations could provide insight and support for future youth physical activity interventions.

Self Esteem

Attention has been paid to the relationship between physical activity and self-esteem. Physical activity is related to self-esteem (Boyd & Hrycaiko, 1997; Collingwood, 1971; Ekeland et al., 2008; Folkins & Sime, 1981; Fox, 2000; MacMahon & Gross 1987; McGowan, Jarman, & Pedersen, 1974; Percy, 1981; Sonstroem, 1984). However, there is contradictory evidence regarding such association (Bruya, 1997; Ford, Puckett, Blessing, & Tucker, 1989; Marsh &

Peart, 1998). To further explore the connection between self-esteem and physical activity, one must first explore the construct of self-esteem as it is understood currently.

The term “self-esteem” is often used interchangeably with “self-concept.” Self-concept includes our sense of identity, as well as our perceived capabilities and limitations. Self-concept also encompasses the discrepancies between the real self (how we perceive ourselves) and the ideal self (who we would like to be) (Johnsgard, 1989). Rogers (1951) defines self concept as “an organized configuration of perceptions of the self which are admissible to awareness.” Self-esteem is often considered the evaluative aspect of self-concept (Rogers, 1951), and is defined as “the awareness of good possessed by the self” (Campbell, 1984). The term “esteem” is defined as both a verb and a noun; “to set value upon,” and “opinion or judgment; estimation; evaluation.” Thus, self-esteem is understood as one’s own judgment of, or with how much value one considers one’s self.

Self-esteem provides an overall statement of the degree to which an individual deems himself/herself to be an “OK” person, which is dependent on the criteria such individual uses to determine “OK” (Fox, 1997). Self-esteem has been accepted as a multidimensional trait which varies depending on individual experiences. The term used for the most stable, all inclusive aspect of self esteem is GSE.

Global self-esteem

GSE is the evaluative aspect of the overall construct of a self-concept hierarchy in which all personal experiences contribute to an individuals’ idea of self. Various models have been proposed regarding the structure of self-esteem. The theory of a global concept of the self over and above more specific self-concepts resulted from the work of two historical scholars of the self, James (1892/1984) and Cooley (1902/1922). Although both viewed this global sense of worth as a hierarchical system, the supposed contributors to self-esteem were a topic of some controversy. One theory postulated that GSE is influenced by the ratio of one's successes to one's pretentions; therefore, ability in domains of importance would primarily contribute to one's GSE (James, 1892/1984). Consequently, ability in domains of little importance would contribute very little to GSE. The other theory presents that the origins of GSE are social in nature, and that the acquisition of the opinions of significant others toward one's self greatly influences one's GSE (Cooley, 1902/1922). These two theorists formed the original model of the self from which most current ideas of self-esteem were derived.

Self-theorists, including and since James and Cooley, consider self-esteem to be a central concept in psychology; it is proposed to provide the only perspective from which an individual's behavior can be understood (Epstein, 1973). Because physical activity is a behavior, this theory would lend itself to the assumption that physical activity and self-concept are somehow associated. The hierarchy of self-esteem, as theorized by James and Cooley, has evolved and postulates have, throughout the years been explored in attempts to more acutely conceptualize the very subjective variant of self-esteem (Epstein, 1973; Harter, 1986). Shavelson, Hubner, & Stanton (1976) identified seven features essential to the constructs definition; self concepts may be described as organized, multifaceted, hierarchical, stable, developmental, evaluative, and differentiable.

A structural model of self-concept, constructed by Shavelson et al. (1976), is presented in Figure 1. Specific domains of self-evaluation are presented as determinants of GSE across the population and have been validated as constructs of esteem within the individual; academic, social, emotional, and physical esteem make up these subcomponents and contribute to the GSE of each person as observed by Shavelson et al. (1976). Experiences within each of these areas

Figure 1. One Possible Representation of the Hierarchic Organization of Self-Concept

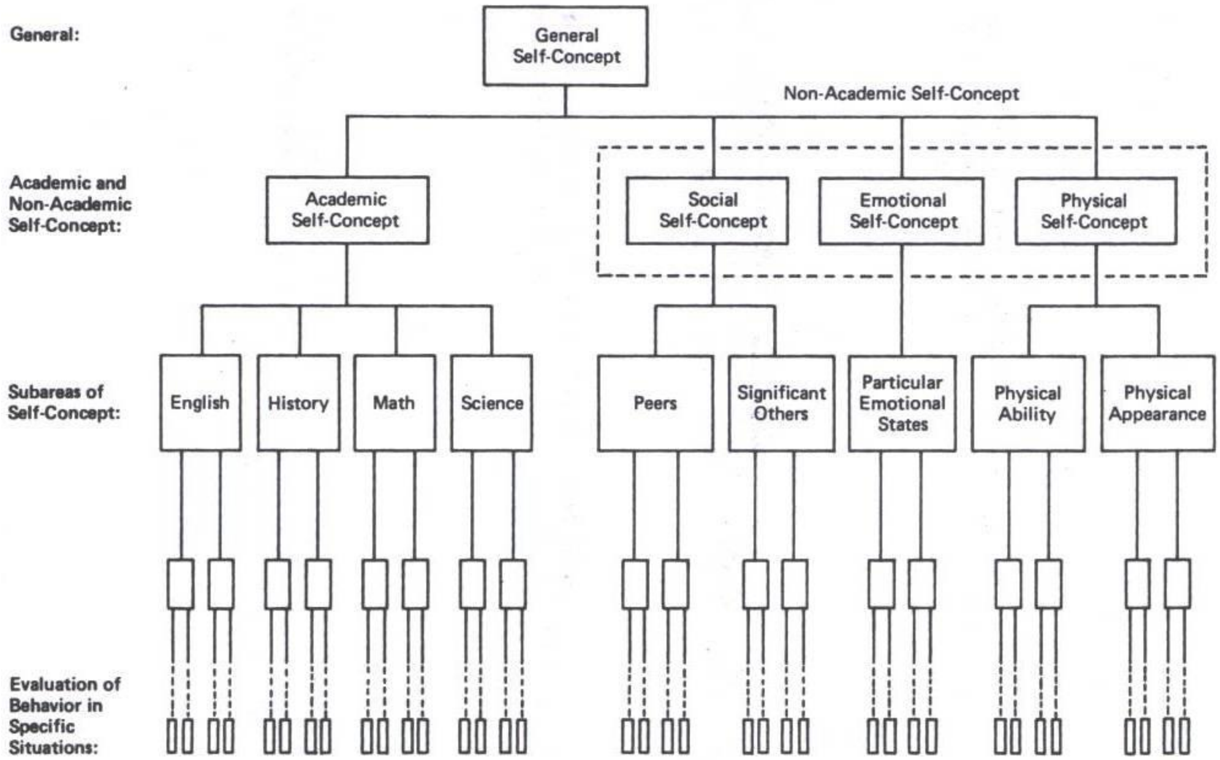

Figure 1. From "Self-Concept: Validation of Construct Interpretations," by Shavelson, R. J., Hubner, J. J., & Stanton, G. C., 1976, *Review of Educational Research*, *46*(3), p. 413. Copyright 1976 by American Educational Research Association. Reprinted with permission.

contribute to one's perception of self in the subcomponent, which contributes to GSE. The level to which each domain contributes to GSE is unclear in various populations, and is particularly uncertain among children.

Across theories, the overall construct of GSE is considered relatively stable and resistant to change. However, a pattern of GSE stability change across the lifespan has been observed (Trzesiewski et al., 2003). The stability of GSE was found to be at its lowest during childhood, subsequently increased through adolescence and young adulthood, and then declined during midlife and old age. Because GSE has been observed as instable among children, one might assume that the overall construct of GSE is malleable as children develop. In accordance with the hierarchical structure of self-concept, less stability can theoretically be expected for lower level contributors to GSE. Thus, the already unstable construct of GSE in youth decreases in stability among specific domains of self-perception.

According to Harter (1982; 1986) the development of domain specific self evaluations contributing to GSE begins at approximately 8 years of age, although, the degree of differentiation may vary among individuals. This is also the age at which the process of comparing the self to others for the purpose of self-evaluation begins (Ruble, 1983; Suls & Sanders, 1982). A longitudinal study, examining fluctuations in GSE among females from childhood, through young adulthood (from ages 9-22) demonstrated differences between races in GSE development (Biro, Striegel-Moore, Franko, Padgett, & Bean, 2006). It is interesting to note that during childhood (8-11 years old) this difference was minimal, if not non-existent; it was not until age 12 that race differences became evident. Additionally, during adolescence, variables associated with GSE (such as reported levels of problem behavior and the interaction between age and BMI) have been observed to be different between genders (Stradmeijer, Bosch, Koops, & Seidell, 2000). Such differences have not been explored in children. These observations lead to the suggestion that, although GSE is least stable during childhood, it may exhibit the most homogeneity across race and gender during this developmental stage.

The amount of contribution to GSE from each esteem domain is dependent on the individual's perceived importance of each domain (Harter, 1986). Additionally, perceived importance of each domain is an independent state specific to the individual. For example, the perceived importance of one's PSW determines the degree to which it contributes to the individual's GSE. If the individual places little importance on PSW, it will contribute mildly to

GSE. However, if PSW is of high importance, it will have great impact on GSE for that individual.

Physical self-worth

It is within the realm of PSW that we find a link between obesity, physical activity, and GSE. The domain of PSW has been shown to be the most robust in its correlation with GSE across populations compared to the other subcategories (Harter, 1993). The construct of PSW has been explored and is theorized to be related to numerous physical self-perceptions including perceived body attractiveness, perceived physical strength, perceived sport competence, and perceived physical condition (Fox, 1987). These physical self-perceptions are indirectly correlated with GSE through their relationship with PSW. The accuracy of this hierarchy was demonstrated among college students with evidence of two properties; PSW showed the highest association with GSE in comparison to each of the subscales, and each of the subscales were more closely related to PSW than to GSE (Fox, 1987). Gender effects have been observed for the physical self-perception subscales indicating that males score higher than females for perceived sports competence (Whitehead & Corbin, 1991).

BMI and Self-Esteem

Similar to its relationship with physical activity, BMI has been shown to correlate negatively with self-esteem (Banis & Varni, 1988; Braet, Mervielde, & Vandereycken, 1997; French, Story, & Perry, 1995; Sallade, 1973; Strauss, Smith, Frame, & Forehand, 1985; Strauss, 2000). Although an association between self-esteem and obesity has been observed, direction of effect is unclear. It is logical to imagine that low self-esteem may be a psychological factor contributing to the development of obesity. Conversely, it is equally as logical to assume that low self-esteem may be a negative psychosocial consequence of obesity. Not enough evidence to support either perspective has been presented.

The evidence for an association between weight status and self-esteem demonstrates that obese individuals may have impaired self-esteem in comparison to healthy weight, populations (Banis & Varni, 1988; Braet et al., 1997; French et al., 1995; Sallade, 1973; Strauss et al., 1985; Strauss, 2000). This remains a highly controversial area with many studies contradicting such conclusions (Kaplan & Wadden 1986; Mendelson & White 1985; Strauss, 2000; Wadden, Foster, Brownell, & Finely, 1984). Many studies, which may or may not have found a significant difference in GSE, were able to demonstrate a significant difference in PSW among obese versus non-obese populations (Banis & Varni, 1988; Mendelson & White, 1985; Strauss, 1985).

Studies among youth examining self- esteem and BMI report inconsistent results (Zametkin et al., 2004). Some studies indicate that obese youth suffer from impaired GSE (Braet et al., 1997; French et al., 1995; Pesa, Syre, & Jones, 2000; Stradmeijer et al., 2000; Strauss, 2000; Zametkin et al., 2004). In fact, an inverse correlation between obesity severity and GSE, PSW, and social self-esteem has been observed among children aged 9-12 years (Braet et al., 1997). Some studies, however, show no significant association between self-esteem and body composition (Gortmaker, Must, Perrin, Sobol, & Dietz, 1993; Zametkin et al., 2004). These conflicting findings may result from sampling differences. Because of the developmental nature of GSE, age groups may exhibit variance in the BMI-GSE association; the same may be said for differing genders. Age grouping and gender discrimination may be responsible for the conflicting findings regarding the BMI-GSE association among youth.

The development of GSE is continuous through life. Fluctuations due to age may provide invaluable information regarding the impact of BMI on self-perceptions. The evolution of the GSE-BMI relationship through adolescence has been observed to be related to severity of overweight. Obese adolescents aged 12-14 were significantly more likely to report diminished self-esteem when compared to overweight adolescents of the same age, as well as older overweight, or obese adolescents (Swallen, Reither, Hass & Meier, 2005). Additionally, looking a bit further into childhood, a study examining a community sample of 8-11 year olds found that overweight children had significantly lower scores for self-esteem than normal weight children (Friedlander, Larkin, Rosen, Palermo, & Redline. 2003). These findings suggest that self-esteem impairment among obese youths may be stronger at younger ages. Conversely, it has been demonstrated that the decreased levels of GSE exhibited by obese individuals is more dramatic with increased age (Sallade, 1973; Stradmeijer et al., 2000).

Age may not be the only variant contributing to conflicting conclusions regarding BMI and self-perception in youth; gender and race have been cited as influential variables of self-esteem in obese youth (Zametkin et al., 2004). Girls have been observed to be more likely to have lowered self- esteem due to the high importance placed on body image (Pesa et al., 2000; Zametkin et al., 2004). This effect seems to be more pronounced with age, as young females progress through adolescence (Israel & Ivanova, 2002; McCabe, Ricciardelli, & Banfield, 2001; Stradmeijer et al., 2000). There is evidence that, among adolescents, the associated decrease in GSE observed with increased BMI may be gender specific, with females at higher risk for diminished GSE (Stradmeijer et al., 2000). It has been observed that GSE was negatively associated with BMI among girls aged 9 – 22. This relation has also been observed to be influenced by race. Although significant negative associations between BMI and GSE were observed for both races, African American girls reported higher GSE than Caucasian girls of the same BMI status (Biro et al., 2006). Although most of the research identifies females as being more at risk for negative affect associated with overweight, there is evidence that males share this experience, however not at the same magnitude as females (McCabe et al., 2001). Despite this observation, a majority of the literature focused on females.

To examine the relationship between age, gender, BMI, GSE and body-esteem, Mendelson & White (1985) conducted a developmental study of self- esteem and body esteem among varying age groups of obese and non-obese youth. The age categories were defined as youngest (range 8.5 to 11.4 years; mean 10 years), middle (range 11.5 to 14.4 years; mean 13 years), and oldest (range 14.5 to 17.4 years; mean 16 years). Overweight children were found to have lower body-esteem than did normal weight children across all age groups. Overweight boys in the youngest category were found to have impaired self- esteem compared to non-overweight boys. The difference between overweight girls and non-overweight girls in the youngest category did not reach significance. This data would suggest that overweight can have an effect on the self-esteem of young boys, which contradicts findings from several studies examining only GSE (Kaplan & Wadden, 1986; Wadden, Foster, Brownell, & Finely, 1984), and supports studies suggesting a more pronounced self-esteem impairment with overweight children in young age groups (Friedlander et al., 2003; Swallen et al., 2005). This provides a link between overweight and self-esteem in young children. Although the overweight children in the youngest group did not exhibit a decreased global esteem level, their body esteem was demonstrated to be impaired. The results of this study agree with others finding that body esteem, which can be likened to Fox's (1987) interpretation of perceived body attractiveness, is more impaired in obese populations than GSE (Banis & Varni, 1988; Strauss, 1985).

PSW appears to be a logical mediator for the relationship between BMI and GSE. A study including 48 Swedish 11-12 year old children showed that BMI was negatively correlated to PSW, perceived sports competence, perceived body attractiveness, and perceived physical condition for both genders (Raustorp, Stahle, Gudasic, Kinnunen, & Mattson, 2005). The most consistent finding is that obese youth have a more negative body image than their normal body weight peers (French et al., 1995; Israel & Ivanova, 2002; Pesa et al., 2000). More specifically, BMI among children was demonstrated to be negatively correlated to perceived body attractiveness and perceived physical condition for both genders in a study including 754 children aged 8-12 years (Welk & Eklund, 2005). Negative body image, accompanied by low self-esteem, can develop as early as 5 years old (Davison & Birch, 2001; Ebbeling, 2002). A lower perceived cognitive ability has been shown to accompany the negative body esteem associated with BMI among 5 year old girls (Davison & Birch, 2001). It has also been observed that BMI is a strong predictor of body satisfaction among adolescents (McCabe et al., 2001). As physical self-perceptions increase in perceived importance, their influence on PSW is strengthened, and they therefore become more potent in their effect on global esteem.

Although it may seem that obesity contributes to the progressive deterioration of self-esteem, one study found evidence demonstrating that a high level of baseline self-esteem contributes to the ability to improve one's obesity status (O'Brien, Smith, Bush, & Peleg, 1990). Over 1,000 black fourth graders participated in a study where they completed the Rosenberg self- esteem scale. Height and weight were also measured. These measures were re-administered 1 to 3 years later. Subjects were classified according to their weight change based on NHANES reference data for height and weight according to age and gender. Categories were formed as follows: 1) Obese at baseline and obese at follow-up; 2) Obese at baseline and non-obese at follow-up; 3) Non-obese at baseline and obese at follow-up; and 4) Non-obese at baseline and non-obese at follow-up. In the obese/non-obese group, baseline measures for self-esteem were a significant predictor of change in adiposity; high levels of baseline self-esteem were related to a decreased adiposity at follow-up.

Additional support for the protective quality of high self esteem was found in a later study. It was observed that children, between 3 – 5.7 years old, exhibited a negative relationship between PSW and future body fat (Klesges, Haddock, Stein, Klesges, Eck, & Hanson, 1992). Those children with higher PSW at young ages developed less body fat over the course of 1 year. Although this effect was seen for both genders, the magnitude between genders differed. Such findings suggest that initial self-esteem levels are associated with changes in obesity status. This evidence, as well as additional benefits of positive self-esteem, support the movement for treatment/programs focused on enhancing the self-esteem of youth to aid in prevention of obesity in adolescence and, subsequently, adulthood.

Despite inconsistent findings regarding the GSE-BMI relationship, several factors such as age, gender, and race, have been demonstrated to influence the association. More consistency is found in the relationship between BMI and PSW among youth. The most commonly observed relationship is that between BMI and physical self-perceptions, particularly perceived body attractiveness. Obese youth have been observed to exhibit impairment in self-perceptions at various levels of the self-esteem hierarchy. It is promising, however, to note that positive self-esteem development may have a protective effect against future weight gain among obese youths.

Self-esteem and physical activity

Global self-esteem and physical activity

Self- esteem has been identified as the variable with the greatest potential to reflect positive psychological gain from regular exercise when compared to variables such as depression, anxiety, body image, personality, or cognition (Hughes, 1984). The findings of O'Brien et al. (1990) implicate that an increase in self-esteem of obese youth could have positive effect on their obesity levels during adolescence, and thus, that of the future generation of adults. If such an increase in self-esteem occurs, adoption of a healthier lifestyle would be more likely than if no such increase was experienced, due to the observed link between self-esteem and exercise motivation and adherence (Fox, 1997). It has been observed that those exhibiting low baseline levels of self- esteem are those most positively affected by exercise (Fox, 1999; Fox, 2000; McGowan, 1974; Scully, Kremer, Meade, Graham, & Dudgeon, 1998; Sonstroem, 1984), and that change in self-esteem score is independent of fitness level (Neale, Sonstroem, & Metz, 1969; Taylor & Fox, 2005). This, coupled with the observation that obese youth suffer from low self-esteem (Banis & Varni, 1988; Braet et al., 1997; French et al., 1995; Sallade, 1973; Strauss et al., 1985; Strauss, 2000), suggests that obese youth would likely demonstrate great gain in self-perceptions through participation in exercise. Exercise interventions may have the potential to increase self-esteem, while aiding in weight loss efforts for overweight individuals.

Evidence supporting exercise interventions, with the purpose of increasing self-esteem, is found in a recent longitudinal study examining the links between physical activity and self-esteem in early adolescent non-Hispanic females (Schmalz, Deane, Birch, & Davison, 2007). Schmalz et al. (2007) observed a 2 year lagged effect of physical activity on self-esteem. The positive effect of physical activity on self-esteem was found to be stronger at younger ages; that is, the effect of physical activity at age 9, on self-esteem at age 11, was larger than the effect of physical activity at age 11, on self-esteem at age 13. In addition to this effect, the authors also found that these lagged positive effects of physical activity on self-esteem were magnified with increasing BMI. Although the strength of effect increased with BMI, the age trend remained consistent; weaker physical activity/GSE associations were seen at older ages. This evidence, as well as the evidence supporting increased impairment of GSE among young overweight children (Friedlander et al., 2003; Swallen et al., 2005), suggests that efforts to improve self-esteem and increase physical activity level should be implemented early in childhood development.

Several studies, with samples differing in age, race, gender, and mental state, have shown an increase in GSE in response to physical activity (Boyd et al., 1997; Collingwood, 1971; MacMahon & Gross 1987; Martinek, Cheffers & Zaichkowsky, 1978; McGowan, 1974; Pauly, Palmer, Wriget, & Pfeiffer, 1982; Percy et al. 1981; Schmalz et al., 2007). In contrast, other studies have shown no such response (Bruya, 1977; Ford et al. 1989). Despite conflicting results, multiple reviews have concluded that GSE is associated with physical activity; however, it has been reported that the nature of activity (type of activity, duration of activity, social context of activity, etc.) that produces changes in youth is questionable (Fox, 1999; Scully et al., 1998; Sonstroem, 1984). A recent review identified several interventional studies examining the effects of physical activity on the self-esteem of children (Ekeland et al., 2008). They concluded that exercise might be an important instrument of self-esteem improvement among children and young people. They added that, for exercise as part of a comprehensive intervention, the effect size is moderate, and effects may only be for the short term. Studies examined have used a variety of measurement tools, exercise intensity, type of physical activity, and intervention duration.

Not every type of physical activity can promote positive changes in self-esteem. Self-esteem among 9-11 year old subjects participating in an exercise intervention, utilizing basketball drills, did not significantly change as a result of the exercise (Bruya, 1977). Another study examining effects of endurance training on self-concepts of seventh grade males with low baseline self-esteem demonstrated evidence of improved self-concept following an 18 week exercise intervention (McGowan et al., 1974). Distance running, a minimum of one mile at least three times per week, for 7 weeks, has also resulted in improved self-esteem among elementary students (Percy, Dziuban, & Martin, 1981). Additional research is needed to determine the appropriate types of activity for self-esteem enhancement in varying populations.

It has also been suggested that exercise programs of longer duration are a vital component for demonstrating improvements in psychological constructs, such as self-esteem (Leith, 2002). However, specific duration recommendations were not provided. Because so little is known about the nature of these effects, and how variables such as age, gender, and health status interact with such effects, there has been a call for further research (Lindwall & Lindgren, 2005; Sonstroem, 1984) examining the length of program necessary to change self-esteem.

Several additional variants may contribute to the conflicting observations regarding the self-esteem physical activity relationship. Further investigation is warranted to more thoroughly understand the nature of this response and more appropriately design physical activity interventions for obese youth.

Physical self-worth, physical self-perceptions, and physical activity

Theoretically, physical activity might have an indirect association with GSE mediated by its association with PSW (Fox, 1997). Relationships of physical activity level and PSW, and its subscales have been documented among youth using physical activity self-report (Biddle & Wang, 2003; Crocker, Eklund, & Kowalski, 2000; Welk & Eklund, 2005) and pedometry (Raustorp et al., 2005). Investigations of self-reported physical activity level and CY-PSPP scales have demonstrated significant, yet differing associations. A large scale study (n = 754) examining 8-12 year olds reported significant positive relationships between physical activity reported by the Physical Activity Questionnaire for Children and all CY-PSPP scales (Welk & Eklund, 2005). Similar findings were reported for a sample of 466 Canadian children (10-14 years), reporting physical activity with the Physical Activity Questionnaire for Older Children, a 7 day recall instrument (Crocker et al., 2000). Conversely, among a group (n = 516) of 11-16 year old English females, physical activity as measured by 7 day physical activity recall questionnaire was reported to be positively associated with perceived body attractiveness, and perceived physical strength, and negatively correlated with perceived sport competence (Biddle & Wang, 2003). Additionally, physical activity of 11-12 year old Swedish children, as measured by pedometry, has demonstrated fair correlation ($.18 \leq r \leq .39$) with CY-PSPP scales among males (n = 248), yet poor correlation ($.07 \leq r \leq .19$) among females (n = 253) (Raustorp et al., 2005).

The impact of physical activity on PSW may be influenced by the extent to which activity participation impacts the more specific physical self-perceptions (Sonstroem, Harlow, & Josephs, 1994). The physical self-perception variables reported to be most responsive to exercise are perceived physical conditioning, perceived physical strength and overall PSW. Perceived body attractiveness seems to be the most resistant to change in response to exercise (Fox, 1997). No statements were made regarding the responsiveness/resistance to change in perceived sport competence resulting from exercise.

Observations of physical self-perceptions, PSW, GSE and physical activity suggest that the effects of physical activity may be more evident among lower order constructs of self-perception than at the global level. A positive change in sports-ability self-esteem as measured by a specially designed sport self-concept test paralleling the format of the Student's Self

Assessment Inventory, was observed for 15 boys ranging from first through fourth grade (Anshel, Muller, & Owens, 1986). Anshel et al. (1986) also reported no change in GSE. Physical self-esteem and social self-esteem, as measured by the Tennessee Self-Concept Scale, among high school females was observed to improve following dance team participation (Blackman, Hunet, Hilyer, & Harrison, 1988). Although post dance team participation scores for the scales measured did not significantly differ from similar females participating in daily physical education, a trend was indicated by lower means among the physical education participants on all scales when compared to the dance team participants. Blackman et al. (1988) reported that the dance team and the physical education participants engaged in no additional physical activity outside of the study. Such observations suggest that type and structure of activity influences the effect of physical activity on physical self-perceptions.

It is also suggested that not every social environment is conductive to such changes among certain populations. In a study comparing a competitive vs. cooperative intervention, participants experienced opposing results in self-concept measures (Marsh & Peart, 1998). This study used a sample of high school girls. The girls in the competitive group experienced a decrease in physical ability self-concept and physical appearance self-concept, as measured by the Self Description Questionnaire II, while the girls in the cooperative group experienced improvements in those same constructs. It may be logical to assume that this observation is gender specific, and perhaps the same study repeated with boys may have a different outcome. Additionally, Bruya (1977) observed no effect in self-perceptions despite the familiar setting of physical education class. These observations demonstrate uncertainty in the specific conditions of physical activity which promote the greatest gain in physical self-perceptions, and may contribute to gains in GSE.

After careful consideration of the body of research examining the effects of physical activity participation on self-esteem and physical self-perceptions of children, Whitehead and Corbin (1997) concluded with a list of suggestions regarding exercise intervention design for successful self-esteem enhancement (see Figure 2.).

Figure 2. Recommendations for Intervention Design for Self-Esteem Gain (Whitehead & Corbin, 1997)

- "DO emphasize task mastery."
- "DON'T overemphasize peer comparison and competition."
- "DO promote self-determination."
- "DON'T make support contingent on performance."
- "DO give appropriate encouragement and technical feedback."
- "DON'T become reliant on extrinsic rewards of pressures."
- "DO promote intrinsic fun and excitement."
- "DON'T turn 'playout' into workout."
- "DO promote a sense of purpose by teaching the value of physical activity to health and wellness."
- "DON'T create amotivation by using poor practice or spreading misinformation."

Further exploration of the extent of contribution to self-esteem gain from each recommendation may provide more specificity in the design of programs for varying populations.

Quality of Life

The concept "Quality of Life (QOL)" encompasses one's overall satisfaction with life, based on values, goals, abilities, and needs (Mannucci, Ricca, Barciulli, Di Bernardo, Travaglini, Cabras, et al., 1999). Facets of life, such as one's job, housing, neighborhood, family relationships, health, standard of living, and other factors compose this evaluative statement of one's state of being (Ware, 1995). Specific facets of quality of life are influenced by one's state of being, or environment, relative to each facet. For example, a life threatening illness may also threaten one's health-related quality of life (HRQOL); downsizing may deplete one's work related quality of life. The most appropriate facet of QOL to examine in relation to physical activity and childhood obesity is HRQOL.

Health-related quality of life (HRQOL)

HRQOL encompasses those aspects of life which are most closely related to health status (Moscatiello et al., 2007). In general, instruments designed to measure HRQOL are categorized as either generic or disease specific (Kushner, Gary, & Foster, 2000). Generic instruments aim to address issues which are universally important to the health of an individual, such as mobility, self care, and physical, emotional, and social function (Guyatt, Naylor, Juniper, Heyland, Jaeschke, & Cook, 1997). Such instruments cover all relevant areas of HRQOL and are suitable for administration to people across populations. Disease specific instruments are designed to obtain information that is relevant to a specific illness (Kushner et al., 2000). Instruments have been designed for obese populations, although primarily for adults.

HRQOL and BMI

It is logical that obesity has deleterious effects on HRQOL. A J-shaped relationship between BMI and HRQOL has been observed among adults in several studies (Doll, Petersen, & Stewart-Brown, 2000; Ford, Moriatry, Zack, Mokdad, & Chapman, 2001; Heo, Allison, Faith, Zhu, & Fontaine, 2003). Underweight individuals have been observed to score lower than normal or overweight individuals, but not as low as obese individuals, on measures of emotional and social well-being (Doll et al., 2000). HRQOL has been observed to be most positive between 18.5 and 30 kg/m^2 (Ford et al., 2001). One study presented evidence that this J-shaped relationship remains consistent among adults >18 years old, after adjusting for age, gender, race, smoking status, education, and income (Heo et al., 2003)

Severity of overweight has been demonstrated to contribute to the magnitude of HRQOL impairment among adults. Obese persons seeking treatment for their adiposity were reported to have greater impairment of HRQOL profiles compared to those not seeking treatment (Fontaine et al., 1996; Fontaine & Barofsky, 2000). Additionally, various subgroups of obese adults, categorized by treatment (or lack thereof), showed an inverse relation between treatment intensity and HRQOL (Kolotkin, Crosby, & Williams, 2002). The continuum of treatment intensity in this study consisted of five categories; 1)non-treatment seeking obese individuals; 2) individuals seeking treatment that involved infrequent meetings in a clinical setting; 3) individuals seeking treatment that involved weekly meetings (such as outpatient weight-loss programs); 4)individuals seeking an intensive 28-day, 7d/week treatment program; 5)individuals seeking gastric bypass surgery. Further explanation of the treatment protocols was not provided. The evidence reported in this study supports additional findings that severity of overweight is inversely correlated with HRQOL (Ford et al., 2001; Doll et al., 2000; Heo et al., 2003).

In more recent years, HRQOL research has begun to focus on youth. As was seen with adults, evidence exists that there is a negative association between HRQOL and severity of overweight/obesity. A recent review examining 28 studies found conclusive evidence of an inverse relationship between weight status and HRQOL of children and adolescents (Tsiros et al., 2009). This was determined to be true for HRQOL measured by self-report as well as parent proxy.

A cross-sectional study examining the HRQOL of severely obese 5 to 18 year olds clearly demonstrates the extent of impairment obese youth face regarding HRQOL (Schwimmer et al., 2003). The data analyzed in this study supports the conclusion that severely obese children and adolescents are 5.5 times more likely to have impaired HRQOL when compared to healthy children of the same demographics, and have comparable HRQOL to children diagnosed with cancer and undergoing chemotherapy (Schwimmer et al., 2003).This is a substantial finding considering that children and adolescents receiving chemotherapy were previously found to have the lowest HRQOL scores when compared to healthy samples and samples suffering from juvenile rheumatoid arthritis, type 1 diabetes mellitus, and congenital heart disease (Schwimmer et al., 2003).

Another cross-sectional study examining the impact of obesity in HRQOL of children demonstrated domain specific impairments associated with BMI (Pinhas-Hamiel et al., 2006). This study evaluated HRQOL in children and adolescents in clinical, and community based samples. A significant difference was found between obese and non-obese subjects, in which obese subjects exhibited impaired HRQOL in physical, social, and school functioning. Also, evidence was found suggesting that severity of overweight is directly associated with such HRQOL impairment; HRQOL physical functioning and social functioning declined with each increase in BMI quartile, and HRQOL school functioning was impaired only among extremely obese subjects. No differences were observed between the community based sample and the clinical sample, therefore, HRQOL impairment seems to be independent of clinical status among obese children and adolescents. There is some evidence to the contrary, however; pediatric obese populations utilizing weight loss interventions have been observed to have a poorer HRQOL than that of non-treatment seeking community samples (Tsiros et al., 2009), again supporting the previously discussed correlation of HRQOL and severity of overweight (Fontaine et al., 1996; Fontaine et al., 2000; Kolotkin et al., 2002; Pinhas-Hamiel et al., 2006).

Differences in HRQOL impairment among obese children and adolescents, according to race, have been observed (Fallon, Tanofsky-Kraff, Normam, McDuffie, Taylor, Cohen, et al., 2005; Modi, Loux, Bell, Harmon, Inge, & Zeller, 2008). Although both African American and Caucasian adolescents demonstrate an inverse relationship between BMI and HRQOL, obese African American adolescents have been observed to report less impairment than Caucasians in HRQOL (Fallon et al., 2005). Additionally, in a study examining generic HRQOL and weight specific HRQOL among obese adolescents, significant race differences were seen for physical, emotional, and social scores of the PedsQL (generic instrument) as well as for body esteem scores measured by the weight specific instrument (Modi et al., 2008). In these observations, African American adolescents exhibited less impaired HRQOL than did Caucasians, agreeing with previous research (Fallon et al., 2005). This racial discrepancy has been challenged, in that, no such race differences were observed in a study examining weight status effects on the HRQOL of fifth graders (Wallander et al., 2009). Age may be a moderating factor of such association.

The development of the relationship between BMI and HRQOL, through childhood and adolescents, is currently not well understood. One study offers insight regarding specific facets of HRQOL, as well as additional psychological variables correlating with BMI status. Swallen et al. (2005) examined the association between HRQOL in a nationally representative sample of adolescents. They found that across all age groups (12-14 years; 15-17 years; 18-20 years) BMI was significantly associated with functional limitations. Additionally, they found that overweight, obese, or underweight adolescents were also more likely to report 1 or more functional limitation. It was also reported that overweight and obese adolescents in the youngest age group (12-14 years) were significantly more likely to be depressed. This was not evident for the older age groups. Obese 12-14 year olds were also found to be significantly more likely to report low self-esteem and poor school and social functioning compared to children their age with a normal BMI.

Others have examined specific domains of HRQOL among youth of varying BMI. Friedlander et al. (2003) report that overweight children 8-11 years old scored lower on scales for psychosocial health, as well as physical functioning, compared to their normal weight peers. Children at risk for overweight also scored significantly lower for physical functioning than their normal weight peers (Friedlander et al., 2003), which agrees with the findings of Swallen et al. (2005) for young adolescents. Exploring these variables among K-4 grade students, Zhang, Fos, Johnson, Kamali, Cox, Zuniga et al. (2008) found that, although measures of physical and psychosocial HRQOL became increasingly impaired as BMI increased, the relationship was not linear. This discrepancy may have been due to the use of proxy report. Perhaps linearity would be evident if self-report had been used. Additionally, the shape of the relationship, which was not reported by Zhang et al. (2008), may reflect the development of this relationship in early childhood. The large age range used leaves Zhang et al.'s findings unclear.

The development of the HRQOL-BMI relationship among children is unclear. There is conclusive evidence, however, that HRQOL is impaired among obese youth. The extent of influence BMI has on HRQOL seems dependent on variables such as age, and possibly race, among children and adolescents. Severity of overweight has demonstrated a clear impact on the extent of HRQOL impairment among adults, yet explorations of this relationship among children are less consistent. More research examining the fluctuations in the HRQOL-BMI relationship through youth is needed to more clearly understand the interaction between HRQOL and physical activity among children of varying BMI.

HRQOL and Physical Activity

There is some evidence that HRQOL is associated with participation in physical activity where those not physically active report lower HRQOL (Brown et al., 2003; Brown et al. 2004; Ford et al., 2001). One study used cross-sectional and longitudinal analysis to interpret HRQOL data for men and women 20-59 years old (Wendel-Vos, Schuit, Tijhuis, & Kromhout, 2004). This study found associations with HRQOL and physical activity in both analyses. Interestingly, the cross-sectional analysis demonstrated a positive association ($p < .05$) between physical activity level and physical components of HRQOL, whereas longitudinal analysis rendered a positive association ($p < .05$) between physical activity level and social components of HRQOL. It has also been shown that higher levels of regular physical activity are associated with fewer unhealthy days, with specific reference to stress, depression, emotional problems, physical illness, and physical injury, across age groups (Brown et al, 2003; Brown et al. 2004). It is unknown if the same associations are present in children.

Summary

Obese populations are observed to have impaired GSE, PSW, physical self-perceptions, and HRQOL, compared to healthy weight populations. Such deleterious effects in childhood can lead to disastrous consequences in adolescence and adulthood. Such associations are shown to be sensitive to gender, age, and, in some cases, race. It is logical to assume that, if BMI is negatively associated with self-perception and quality of life variables, it would be desirable to design interventions to aim for a healthier BMI among overweight and obese youth. Physical activity has been observed to be positively associated with GSE, PSW, and HRQOL, and has the added benefit of weight loss.

Chapter 3: Methods

Procedures

Recruitment focused on prepubescent children from Pitt County, NC. Local physical education teachers, school nurses, pediatricians, and newspaper advertisements were utilized in the recruitment attempt. Participants were also recruited via email and referrals from various medical personnel.

Upon recruitment, an initial meeting was scheduled with the parent and child, during which a detailed explanation of the study, its procedures, risks and benefits was given to the child and parent. If they both agreed to participate, informed consent and child ascent were obtained. At this time, the participant underwent screening for cardiovascular and peripheral vascular disease and non-insulin dependent diabetes mellitus in accordance with a larger study funded by the National Institutes of Health (Grant #DK071081 R. Hickner, Principle Investigator); a medical history form was completed and a physical examination performed. Testing was also conducted to obtain body composition measurements, as well as measurements relevant to the larger NIH-funded study. While in attendance for such measurements, the participants completed the Children and Youth Physical Self-Perception Profile (CY-PSPP), with embedded Children and Youth Self-Perception Profile (CY-SPP) and Children's Attraction to Physical Activity (CAPA) scale, and the Pediatric Quality of Life Scale (PedsQL 4.0). Prior to absolute enrollment in the study, each participant wore a pedometer and accelerometer, for five consecutive days (2 weekend days and 3 week days), to assess their physical activity level. Once the inclusion criteria had been met according to the standards of the NIH-funded study, the participant scheduled his/ her first week of exercise sessions if in the experimental group, and the follow-up dates if in the control group.

Following the initial measures, the participants in the experimental group underwent an exercise intervention. Participants performed moderate to vigorous exercise assessed by HR monitor for one hour, three days per week, for 16 weeks. For the purpose of this study, a heart rate of ≥140 beats per minute was considered moderate to vigorous intensity. This target heart rate falls at about 70% of the age predicted maximum heart rate for children in this age group. An average heart rate was recorded at the end of each activity session to monitor the maintenance of these parameters. One-on-one training was likely, but groups of up to three or four were utilized depending on scheduling factors. Physical activity supervisors (senior undergraduate exercise and sport science interns, or exercise and sport science graduate students) were responsible for ensuring that participants maintain the proper level of physical activity. Participants were provided with a variety of activities to choose from each session. Options included, but were not limited to, racquetball, basketball, tennis, kickball, soccer, running/jogging, and various games of low organization.

At the end of the 16 week intervention, participants underwent the same testing which was administered pre-intervention. During this time, participants once again completed the CY-PSPP and PedsQL 4.0.

Participants

Participants for this study included obese and healthy weight, as defined by the CDC, children undergoing experimental research (NIH grant #DK071081), ranging in age from 8 -11 years. Participants were required to be in good health and regularly sedentary to be considered for participation. Participants were excluded if they were participating in >30 min/day, > 3 days/ week of exercise, as indicated by self-report. Individuals presenting with contraindications to exercise or other problems which may interfere with performance in the exercise intervention were excluded. The sample size available for the current exploration was N = 40. The sample was randomly assigned to groups using a 2:1 ratio, by a computer-based random number generator.

Measurements/ Tools

The children and youth physical self perception profile (CY-PSPP)

The CY-PSPP is composed of six scales representing the hierarchical arrangement of self-perceptions including GSE, PSW, perceived physical strength, perceived body attractiveness, perceived physical condition, and perceived sport competence (Whitehead, 1995). Each scale is assessed with six items, each scored on a four point likert type scale. The average of the items for each scale represents the value for the respective scale. Each item uses a structured alternative format to reduce the tendency for socially desirable responses (Harter, 1982). In this format, each respondent first selected the most appropriate descriptive statement from two opposing statements (e.g., “Some kids are proud of themselves physically” or “Other kids don’t have much to be proud about physically”) to describe him or herself. He or she then considered whether the statement was “sort of true” about him or her, or “really true” of him or her, and reported the most appropriate selection. Each item was then scored between 1 and 4, with 1 reflecting the most negative response and 4 reflecting the most positive response. The reliability and validity of this questionnaire ($p < .001$) has been confirmed among children ages 8-12 (Eklund, Whitehead, & Welk, 1997; Welk & Eklund, 2005). A large scale study was also able to provide evidence of validity ($p < .0001$), via confirmatory factor analysis, with young (8-12 years old) children (Welk & Eklund, 2005).

Children’s attraction to physical activity scale (CAPA)

The CAPA (Brustad, 1993) was used to measure whether children’s attraction to physical activity changed over time. The following subscales are included in the questionnaire and provide a representation of attraction to physical activity and have demonstrated acceptable internal consistency among fourth graders with alpha levels ranging from .62 to .78 (Brustad, 1993); Liking of Games and Sports (LGS); Liking of Physical Exertion (LPE); Liking of Vigorous Exercise (LVE). Smith (1999) reported internal consistencies of $\alpha = 0.87$ (LGS), $\alpha = 0.75$ (LPE), and $\alpha = 0.76$ (LVE), in adolescents aged 12 to 15 years. In a study to evaluate the scales' psychometric properties, a shortened version (each subscale reduced to four items) provided good model fit through structural equation modeling (Rowe, Raedeke, Wiersma, & Mahar, 2007). This shortened version was administered embedded within the CY-PSPP.

Pediatric quality of life inventory version 4.0 (PedsQL 4.0)

HRQOL in pediatric populations can be measured from the individuals' perspective; however, if the children are too young or unwell to self-report, parental proxy can be used. The PedsQL 4.0 (Varni, Seid, & Rode, 1999) is a self-report instrument designed to measure health- related quality of life (HRQOL) in children aged 2-18 years. This scale is a generic instrument to be used across populations in the specified age group. The PedsQL 4.0 consists of 23 items measuring the core health dimensions of physical (8 items), emotional (5 items), social (5 items), and school (5 items) functioning. This is the only generic HRQOL measurement tool available which is appropriate for assessing the age span of 2- 18 years. Validation of this inventory confirms high internal consistency reliability *($\alpha = 0.88$)* and validity *($p < .0001$)* for the total scale score (Varni, Seid, & Kurtin, 2001). The PedsQL 4.0 is scored so that higher scores indicate increasingly impaired quality of life.

BMI

BMI was calculated using height (m) and weight (kg) in the following formula: BMI =

kg/m^2. Height was measured with a stadiometer, and weight was measured using a Cardinal Detecto digital scale (model #708, Webb City, MO, USA). Obesity was identified according to BMI percentile where healthy weight was defined as $\leq 85^{th}$ percentile, and obese was defined as $\geq 95^{th}$ percentile, for age and gender (Kuczmarski et al., 2002), as used in a recent study reporting the use of BMI as an indicator of body fatness and risk among children, and is reported to be a moderately sensitive and specific indicator of excess adiposity in children (Freedman & Sherry, 2009). BMI charts for boys and girls can be found at www.cdc.gov/growthcharts. Use of this website provided appropriate BMI percentile rankings for each participant according to age, gender, and BMI.

Activity Monitor

Actigraph accelerometers (Actigraph Model GT1M, Actigraph LLC; Pensacola, FL, USA) were used to quantify physical activity. The validity of these instruments has been demonstrated for all levels of physical activity intensity among a sample of children ranging in age from 6 to 16 years old against activity energy expenditure as measured by room respiration calorimetry (Puyau, Adolph, Vohra, & Butte, 2002).

The accelerometers were worn by each participant for three to five days prior to, and immediately following the 16 week experiment duration. The devices were set with 60 second epochs. A valid day was one during which the participant wore the accelerometer for at least 7 full hours. Data retrieved was in the form of activity counts per minute. Cutoffs for activity intensity were <500 counts, 500-2000 counts, >2000 to <3000 counts, and >3000 counts per minute for sedentary, light, moderate, and vigorous intensities, respectively, as set by the primary investigator of the cohort study. Computed values for average minutes of MVPA per day (the variable used to represent physical activity in the current study) for each participant were obtained by summing the minutes spent in MVPA over the 3-5 day span, as defined by cutoff values, and dividing by number of valid days.

Polar heart rate monitors were used to track activity level during the exercise intervention for those in the experimental group. The validity of these monitors in measuring the heart rate of children at rest has been demonstrated (Gamelin, Baquet, Berthoin, & Bosquet, 2008), however, evidence of the validity of this tool among children during exercise has yet to be presented. One study examined the validity of Polar heart rate monitors during progressive cycling exercise among 8 young adults; it was observed that the devices are consistent with ECG recordings, although it was reported that the relationship was diminished at higher intensities (Kingsley, Lewis, & Marson, 2005).

Analysis

Statistical analyses were completed using PASW statistics (version 17.0.2 for Windows). Descriptive statistics were calculated for the sample. Preliminary reliability analyses were run for each outcome variable to ensure that each scale was internally consistent. To examine the relationship between the psychological variables and MVPA, bivariate correlation was performed for each of psychological scales, and average minutes of MVPA. To evaluate whether the exercise and control groups were equivalent regarding self-perceptions and quality of life at baseline, independent samples *t-test*s comparing the two conditions were computed for each subscale. Subsequently, to examine the effect of the exercise intervention on each dependent variable, a series of 2 (condition) x2 (time) repeated measures analysis of variance (ANOVA's) were performed. Independent samples *t*-tests were used to compare all dependent variables for obese and healthy weight children at baseline and follow up. Repeated measures 2 (condition) x 2 (time) ANOVA's were run for all obese participants and all healthy weight participants to examine intervention effects according to BMI status.

Ancillary analyses were performed in an attempt to better understand the sample characteristics and their relationship with the outcome variables, as well as to explore the variables measured with CAPA. Independent samples *t*-tests were run to examine differences between groups for the CAPA subscale scores. A 2 (condition) x 2 (time) repeated measures ANOVA was computed to evaluate the effect of the intervention on attraction toward physical activity.

It has been observed that gender differences exist for physical self-perception and GSE, and that race can influence self-perception scores (Biro et al., 2006; Mendelson & White, 1985; Pesa et al., 2000; Zametkin et al., 2004). As suggested in previous literature (Eklund, Whitehead, & Welk, 1997), analyses were run to examine differences between gender (male/female) and race (Caucasian/African American) to more acutely identify differences among the population represented by our sample. A series of *t*-tests were utilized to better describe differences of all measurements taken within the sample, as well as within groups, according to gender, and race at baseline and follow up. Also, 2 (condition) x 2 (time) ANOVAs were performed to examine the time effect, as well as the effect of the intervention, on all measured variables, for both groups, according to gender and race. Significance level for all analyses was set as $p < .05$.

Chapter 4: Results

Descriptive Statistics for the Total Sample

The sample size available for this exploration was *N* = 40. A total of 18 females and 22 males, between the ages of 8 and 11 years, participated in the investigation. The sample included 26 Caucasian and 14 African American children. The mean BMI-for-age for the entire sample was 82.33%tile (SD = 24.20). The mean age of the total sample was 9.55 years (SD = .99).

Instrument Reliability

Table 1.
Alpha Coefficients for Psychological Scales at Both Time Points

Scale	Baseline	Follow-up
GSE[a]	.78	.80
PSW[b]	.90	.82
Perceived physical strength	.79	.96
Perceived body attractiveness	.84	.88
Perceived physical condition	.83	.88
Perceived sports competence	.74	.83
Liking of games and sports	.63	.87
Liking of vigorous exercise and exertion	.78	.75
HRQOL school functioning	.62	.66
HRQOL social functioning	.80	.81
HRQOL emotional functioning	.65	.77
HRQOL physical functioning	.71	.69

[a]Global self-esteem (GSE) [b]Physical self-worth (PSW)

To test internal consistency of the instruments used, *Cronbach's alpha* values were computed for each scale measured in the CY-PSPP, PedsQL 4.0 and CAPA (see Table 1). Reliability analysis for each of the CY-PSPP variables demonstrated that all scales had acceptable internal consistency ($\alpha \geq .70$).

Although $\alpha \geq .70$ is often considered acceptable, several scales measured by the PedsQL 4.0 had alpha coefficients close to .70 ($\alpha > .60$), and were retained for the analyses. Diminished reliability was demonstrated for HRQOL physical functioning (baseline α = .69; follow-up α = .60). The internal consistency of HRQOL physical functioning subscale was improved (baseline α = .71; follow-up α = .69) with the removal of one item *("It is hard for me to do chores around the house.")*. Compared to older youth samples, this item may not be appropriate for this age group.

Alpha coefficients for the CAPA scales were computed given their use in ancillary analyses. Diminished reliability was found for "liking of vigorous exercise" (baseline α = .66; follow-up α = .68) and "liking of exertion" (baseline α = .63; follow-up α = .47) subscales. The reliability of the "liking of vigorous activity" and "liking of exertion" subscales was improved by the combination of these two subscales (baseline α = .78; follow-up α = .75), and is justified in that the two subscales assess similar concepts.

Correlation of Psychological Variables and MVPA

Table 2.
Pearson's Correlation Coefficient for MVPA with Psychological Variables at Both Time Points

Psychological variable	Baseline MVPA[a]	Follow-up MVPA[b]
GSE[c]	-.02	-.14
PSW[d]	.09	-.10
Perceived physical strength	-.10	-.01
Perceived body attractiveness	.01	-.09
Perceived physical condition	.13	.06
Perceived sport competence	.11	.17
Liking of games and sports	-.14	.10
Liking of vigorous exercise and exertion	-.05	-.02
HRQOL school functioning	-.04	.08
HRQOL social functioning	-.03	.05
HRQOL emotional functioning	-.08	.07
HRQOL physical functioning	-.17	.19

[a, b] Average minutes of moderate to vigorous physical activity per day (MVPA). [c]Global self-esteem (GSE). [d]Physical self-worth (PSW)

To examine whether self-perceptions and quality of life were related to MVPA at both the baseline and follow-up, Pearson's Correlation Coefficients were computed (see Table 2). MVPA did not significantly correlate with any of the psychological variables, at either time point.

Homogeneity of Participants in Each Condition

Table 3.

Sampling Sizes According to Gender, Race, and BMI Status per Condition

	n	Female *n*	Male *n*	Caucasian *n*	African American *n*	Obese[a] *n*	Healthy weight[b] *n*
Experimental	26	14	12	17	9	18	8
Control	14	4	10	9	5	5	9

[a]Obese is identified as ≥95% BMI-for-age. [b]Healthy weight is identified as <85% BMI-for-age.

Sampling distributions for each condition according to gender, race, and obesity status are listed in Table 3. Mean ages in the experimental and control conditions were 9.54 (SD = .91) years and 9.57 (SD = 1.16) years, respectively. Mean BMI-for-age for the experimental and

Table 4.

Independent Samples T-Test Comparing all Measured Variables Between Conditions at Baseline

	Experimental		Control			
	M	*SD*	*M*	*SD*	*t*	*p*
MVPA[a]	40.34	27.34	57.66	28.67	-1.88	.07
GSE[b]	3.50	.54	3.44	.52	.36	.72
PSW[c]	3.32	.73	3.46	.69	-.62	.54
Perceived physical strength	2.99	.62	3.38	.55	-2.00	.05
Perceived body attractiveness	2.65	.85	2.98	.57	-1.31	.20
Perceived physical condition	2.93	.70	3.21	.75	-1.80	.08
Perceived sport competence	3.30	.51	3.41	.57	-.63	.54
Liking of games and sports	3.51	.57	3.68	.38	-1.02	.31
Liking of vigorous exercise and exertion	2.96	.59	3.30	.53	-1.16	.25
HRQOL school functioning	.78	.58	.65	.46	.74	.46
HRQOL social functioning	.78	.83	.49	.48	1.20	.24
HRQOL emotional functioning	1.03	.72	.71	.63	1.39	.17
HRQOL physical functioning	.79	.60	.40	.35	2.20	.03

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

control conditions were 89.58%tile (SD = 15.58), and 68.86%tile (SD = 31.47), respectively.

To evaluate whether participants in each condition were similar at baseline on MVPA level, as well as all psychological variables, a series of dependent sample *t*-tests were conducted. Overall, these analyses revealed that the groups were similar on most measures (see Table 4). In fact, it was observed that only two variables were significantly different at baseline between experimental and control conditions. Specifically, HRQOL physical functioning was significantly higher ($t = 2.20$; $p < .05$) indicating poorer quality of life among participants in the experimental condition, and perceived physical strength was higher among participants in the control condition indicating more favorable perceived physical strength.

Table 5.
Independent Samples T-Test Comparing all Measured Variables Between Conditions at Follow-Up

	Experimental		Control			
Scale	*M*	*SD*	*M*	*SD*	*t*	*p*
MVPA[a]	39.48	30.77	38.39	29.17	.11	.91
GSE[b]	3.54	.52	3.63	.43	-.56	.58
PSW[c]	3.41	.52	3.56	.50	-.86	.39
Perceived physical strength	3.21	.72	.350	.62	-1.26	.22
Perceived body attractiveness	2.93	.81	3.39	.49	-1.89	.07
Perceived physical condition	3.21	.64	3.37	.71	-.74	.53
Perceived sport competence	3.36	.66	3.50	.49	-.70	.49
Liking of games and sports	3.67	.55	3.73	.55	-.33	.75
Liking of vigorous exercise and exertion	3.19	.55	3.30	.50	-.64	.46
HRQOL school functioning	1.11	.73	.93	.66	.77	.45
HRQOL social functioning	.76	.67	.50	.35	1.35	.18
HRQOL emotional functioning	1.06	.82	.96	.65	.40	.69
HRQOL physical functioning	.74	.65	.52	.41	1.15	.26

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

To determine if the similarities observed at baseline were present at post test, independent samples *t*-tests were computed for follow-up scores (see Table 5). At follow up, the groups appeared more homogenous than at baseline. Significant differences were not found between conditions for any of the dependent variables.

BMI Status Differences among Self-Perceptions, Quality of Life, and Physical Activity

Table 6.
T-Tests Comparing Baseline Levels of all Variables Between Obese and Healthy Weight Participants

Scale	Obese		Healthy weight			
	M	*SD*	*M*	*SD*	*t*	*p*
MVPA[a]	40.98	30.62	30.62	7.85	-1.41	.17
GSE[b]	3.48	.51	3.48	.57	-.01	.99
PSW[c]	3.31	.69	3.44	.74	-.55	.58
Perceived physical strength	2.50	.60	3.28	.61	-1.34	.19
Perceived body attractiveness	2.50	.75	3.12	.67	-2.72	.01
Perceived physical condition	2.98	.65	3.09	.83	-.46	.65
Perceived sport competence	3.36	.50	3.29	.58	.40	.69
Liking of games and sports	3.57	.48	3.57	.54	-.05	.96
Liking of vigorous exercise and exertion	3.05	.58	3.10	.61	-.26	.80
HRQOL school functioning	.64	.57	.86	.49	-1.24	.23
HRQOL social functioning	.82	.88	.48	.44	1.44	.16
HRQOL emotional functioning	1.01	.74	.80	.64	.94	.36
HRQOL physical functioning	.80	.59	.45	.43	2.03	.05

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

To examine whether obese and healthy weight participants across the experimental and control conditions differed on outcome variables, a series of independent samples *t*-tests were conducted at both baseline and follow up. Significant differences at baseline between healthy weight and obese children in the experimental and control conditions were found (see Table 6). Obese children experienced significantly lower perceived body attractiveness ($t = 2.72$; $p \leq .01$) and HRQOL physical functioning ($t = 2.03$; $p \leq .05$). All other dependent variables at baseline was similar between healthy weight and obese participants.

Subsequently, follow-up scores demonstrated a similar difference between BMI status for the variable perceived body attractiveness ($t = -2.72$; $p \leq .01$) with healthy weight children scoring higher than obese children. All other variables did not differ according to BMI status at follow-up (see Table 7).

Table 7.
T-Tests Comparing Follow-Up Levels of all Variables Between Obese and Healthy Weight Participants

	Obese		Healthy weight			
Scale	*M*	*SD*	*M*	*SD*	*T*	*p*
MVPA[a]	42.71	32.21	34.21	26.47	.89	.31
GSE[b]	3.55	.50	3.58	.48	-.19	.85
PSW[c]	3.43	.51	3.51	.51	-.45	.65
Perceived physical strength	3.24	.71	3.41	.68	-.77	.45
Perceived body attractiveness	2.84	.79	3.43	.50	-2.72	.01
Perceived physical condition	3.16	.57	3.40	.76	-1.15	.26
Perceived sport competence	3.35	.62	3.49	.58	-.74	.47
Liking of games and sports	3.57	.55	3.57	.55	.03	.98
Liking of vigorous exercise and exertion	3.17	.57	3.31	.47	-.80	.43
HRQOL school functioning	1.03	.69	1.07	.71	-.20	.85
HRQOL social functioning	.81	.71	.48	.30	1.78	.08
HRQOL emotional functioning	1.10	.89	.93	.53	.69	.49
HRQOL physical functioning	.75	.64	.53	.48	1.18	.25

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

Effects of the Exercise Intervention on the Psychological Variables, and Level of Physical Activity

To examine whether participation in a structured exercise program resulted in improved self-perceptions, quality of life, or MVPA, a series of 2 (condition) x 2 (time) repeated measures ANOVAs were completed (see Table 8). These analyses indicated no significant changes resulting from the intervention. However, a significant change was seen over time across both conditions for self-perception variables perceived body attractiveness ($F = 11.02$; $p < .01$), perceived physical condition ($F = 5.34$; $p < .05$), and perceived physical strength ($F = 4.21$; $p < .05$), all of which significantly improved. Additionally, a significant decline in HRQOL school functioning ($F = 9.91$; $p < .01$) was observed over time. No significant effects were seen for MVPA. Means and standard deviations of all measured variables for the experimental and control conditions are displayed in Appendix B.

Table 8.
2 X 2 ANOVA Comparing the Experimental and Control Conditions on Outcome Variable

Scale	Pre *M*	Pre *SD*	Post *M*	Post *SD*	Time effect *F*	Time effect *P*	Time effect ES	Time X condition interaction *F*	Time X condition interaction *p*
MVPA[a]	46.40	28.69	39.10	29.84	2.63	.11	-.25	2.20	.15
GSE[b]	3.48	.52	3.57	.49	1.87	.18	.17	.96	.33
PSW[c]	3.37	.71	3.47	.51	1.30	.26	.16	.00	1.00
Perceived physical strength	3.12	.62	3.32	.70	4.21	.05	.29	.40	.53
Perceived body attractiveness	2.76	.77	3.09	.74	11.01	.00	.44	.31	.58
Perceived physical condition	3.03	.72	3.26	.66	5.34	.03	.34	.37	.55
Perceived sport competence	3.33	.53	3.41	.60	1.26	.27	.14	.05	.83
Liking of games and sports	3.57	.50	3.69	.54	1.97	.17	.24	.51	.48
Liking of vigorous exercise and exertion	3.08	.58	3.23	.53	2.40	.13	.28	2.06	.16
HRQOL school functioning	.73	.54	1.05	.70	9.91	.00	.50	.05	.82
HRQOL social functioning	.68	.74	.67	.59	.00	1.00	-.01	.02	.88
HRQOL emotional functioning	.92	.70	1.03	.76	1.47	.23	.15	.89	.35
HRQOL physical functioning	.65	.55	.66	.58	.17	.69	.01	1.07	.31

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

Effects of the Exercise Intervention According to BMI Status

In order to examine the intervention's effects separately for obese and healthy weight participants, two 2 (condition) x 2 (time) ANOVAs were completed. Overall, obese participants' PA, self-perceptions, and quality of life did not change for either condition. Obese participants did exhibit a time effect in which HRQOL school functioning (F = 7.60; p < .05) was lower at the post test compared to baseline (see Table 9).

Table 9.
2 X 2 ANOVA Comparing Outcome Variables Among Obese Participants in Experimental and Control Conditions

Scale	Pre		Post		Time effect			Time X condition interaction	
	M	*SD*	*M*	*SD*	*F*	*P*	ES	*F*	*p*
MVPA[a]	40.98	30.62	42.71	32.21	.48	.50	.06	2.37	.14
GSE[b]	3.48	.51	3.55	.50	1.73	.20	.14	1.84	.19
PSW[c]	3.31	.69	3.43	.51	1.77	.20	.20	.68	.42
Perceived physical strength	3.01	.60	3.24	.71	2.24	.15	.35	.02	.90
Perceived body attractiveness	2.50	.75	2.84	.97	4.10	.06	.40	.27	.61
Perceived physical condition	2.98	.65	3.16	.57	.92	.35	.29	.03	.87
Perceived sport competence	3.36	.50	3.35	.62	.03	.82	-.02	.01	.92
Liking of games and sports	3.57	.48	3.70	.55	1.39	.25	.25	.01	.92
Liking of vigorous exercise and exertion	3.05	.58	3.17	.57	.20	.66	.21	.69	.42
HRQOL school functioning	.64	.57	1.03	.69	7.60	.01	.60	.31	.58
HRQOL social functioning	.82	.88	.81	.71	.02	.90	-.01	.09	.76
HRQOL emotional functioning	1.01	.74	1.10	.89	2.21	.15	.11	3.19	.09
HRQOL physical functioning	.80	.59	.75	.64	.01	.93	-.07	.50	.49

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

Conversely, healthy weight children in both the exercise and control conditions demonstrated significant improvements on several variables including perceived body attractiveness (F = 10.72; p < .01), perceived physical condition (F = 10.66; p < .01), and perceived sport competence (F = 4.85; p < .05) over time (see Table 10). A significant decrease over time was seen among healthy weight children in MVPA (F = 5.84; p < .05). The exercise intervention did not appear to effect self-perceptions or quality of life in healthy weight children

Table 10.
2 X 2 ANOVA Comparing Outcome Variables Among Healthy Weight Participants in Experimental and Control Conditions

	Pre		Post		Time effect			Time X condition interaction	
Subscale	*M*	*SD*	*M*	*SD*	*F*	*p*	ES	*F*	*p*
MVPA[a]	53.73	24.85	34.21	26.47	5.84	.03	-.76	.05	.83
GSE[b]	3.48	.57	3.46	.45	1.02	.33	-.04	.01	.92
PSW[c]	3.44	.74	3.51	.51	.39	.54	.11	.57	.46
Perceived physical strength	3.28	.64	3.41	.68	1.74	.21	.21	.36	.56
Perceived body attractiveness	3.12	.67	3.43	.50	10.72	.01	.54	.18	.68
Perceived physical condition	3.09	.83	3.40	.76	10.66	.01	.39	2.19	.16
Liking of games and sports	3.57	.54	3.69	.55	1.10	.31	.22	1.10	.31
Perceived sport competence	3.29	.58	3.49	.60	4.85	.04	.33	.12	.73
Liking of vigorous exercise and exertion	3.11	.61	3.31	.47	4.40	.05	.37	2.86	.11
HRQOL school functioning	.86	.49	1.00	.76	2.78	.12	.23	.28	.61
HRQOL social functioning	.48	.44	.48	.30	.00	.99	.00	.06	.81
HRQOL emotional functioning	.80	.64	.93	.53	.90	.36	.22	.40	.54
HRQOL physical functioning	.45	.43	.53	.48	1.16	.30	.17	.21	.66

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

evident by the insignificant condition X time interactions. Means and standard deviations for all dependent variables from the experimental and control conditions for these analyses are displayed in Appendix C.

Chapter 5: Discussion

The current study examined the relationship of physical activity level (i.e., minutes of MVPA per day) with self-perceptions and quality of life in regularly inactive 8-11 year olds. Additionally, this study examined the effects of a 16 week basic exercise intervention on GSE, PSW, domain specific self-perceptions (i.e., perceived physical strength, perceived physical condition, perceived body attractiveness, and perceived sport competence), HRQOL, and MVPA level in inactive 8-11 year olds. Finally, this study evaluated whether healthy weight and obese children exhibited similar changes in self-perceptions, quality of life, and MVPA level, as a result of exercise participation.

Overall, results revealed the exercise intervention implemented in this study had no effect on self-perception variables, HRQOL variables, or physical activity level. These findings were corroborated by the correlational analyses which revealed that minutes of MVPA across the control and exercise groups were unrelated with self-perceptions and quality of life. These observations suggest that a basic exercise intervention is insufficient in increasing GSE, PSW, physical self-perceptions, HRQOL, and activity level in regularly inactive children 8-11 years of age. They also suggest that overall activity levels are unrelated to self-perceptions and quality of life in inactive children in this age range.

Despite several documented associations between physical self perceptions and physical activity level (Biddle & Wang, 2003; Crocker et al., 2000; Raustorp et al., 2005; Welk & Eklund, 2005), as well as HRQOL and physical activity (Brown et al., 2003; Brown et al. 2004; Ford et al., 2001), average minutes of MVPA per day did not significantly correlate with any of the psychological outcome variables in the current sample of children 8-11 years of age.

In contrast to results from the current study, previous research as demonstrated an association between a variety of self-perception related variables and physical activity. Specific to youth, a significant association between physical activity, and all CY-PSPP variables (including GSE, PSW, perceived physical strength, perceived physical condition, perceived body attractiveness, and perceived sport competence) has been demonstrated among a large sample of 10-14 year old children (Crocker et al., 2000), as well as a large sample of children 8-12 years (Welk & Eklund, 2005). The association has been observed to be gender dependent with 8-12 year old boys exhibiting stronger associations between physical activity and CY-PSPP scales than girls (Raustorp et al., 2005; Welk & Eklund, 2005). There is also evidence that physical activity may be more strongly associated with domain specific self-perception variables compared to more global constructs like GSE. For example, Biddle and Wang (2003) observed physical activity to be significantly associated with perceived body attractiveness, perceived sport competence, and perceived physical strength, but not with GSE, PSW, or perceived physical condition among adolescents. These observations were made with differing types of physical activity assessment. While some investigators focused on MVPA (Crocker et al., 2000), others measured total physical activity accumulated, as indicated by questionnaire (Welk & Eklund, 2005; Biddle & Wang, 2003) or pedometry (Raustorp et al., 2005).

A positive association between HRQOL and total physical activity (Ford et al., 2001), as well as leisure time physical activity (Wendel-Vos et al., 2004) has been observed among adults. Additionally, total physical activity level has been observed to be negatively associated with amount of unhealthy days among adults (Brown et al., 2003; Brown et al., 2004). Little is known about this relationship among children. Additionally, no reports have been published examining the effect of physical activity on HRQOL among children. In contrast to the findings based on adults (Ford et al., 2001; Brown et al., 2003; Brown et al., 2004; Wendell-Voss et al., 2004), the correlation coefficients observed prior to the intervention in the current study for MVPA and each of the HRQOL domains were all very close to zero. This suggests no relationship between level of MVPA and feelings of physical, emotional, social, or academic well-being among inactive children of 8-11 years.

Although the lack of association between MVPA and outcome variables may mean that self-perceptions and quality of life are unrelated to activity levels in children, it could also be due to the nature of the sample. Children who participated in the study were inactive at the onset of the study, thus resulting in a restricted range of activity levels, thereby resulting in a diminished correlation. MVPA levels were similar across the sample due to inclusion requirements (children who participated in 30 minutes of exercise on 3 or more days per week were ineligible for study involvement). As expected participants in both the exercise and control condition were found to have similar levels of MVPA at baseline. Perhaps, by examining a sample that included a broader range of activity levels, we may have observed a relationship of MVPA with self-perception and quality of life variables.

Given the MVPA was unrelated to self-perceptions or quality of life, it came as no surprise that the exercise intervention implemented in this study had no effect on self-perception variables, or HRQOL variables.

Theoretically, exercise interventions should have a greater effect on physical activity related self-perceptions compared to more global ones such as GSE. Thus, effects from this study's exercise intervention on GSE may not have been evident due to the relatively high stability of GSE compared to lower levels of self-perception. In particular, a 16 week intervention may not be sufficient in duration to elicit changes in self-perceptions or quality of life. This is particularly true for relatively stable self-perceptions such as GSE. For example, Schmalz et al. (2007) found that the effect of exercise on self-esteem was evident two years after initial physical activity participation, and was stronger at young ages and with increasing BMI (i.e., physical activity at younger ages had a stronger impact on follow-up self-esteem levels than physical activity later in childhood, and the impact of physical activity on self-esteem was positively associated with BMI).

Due to the stability of GSE, in comparison to PSW and physical self-perceptions, one might expect that activity level would correlate more highly with some of the lower level domains of physical self-perception, such as perceived sports competence, body attractiveness, physical condition and physical strength. It was surprising that the exercise intervention did not impact lower order domains of physical self-perception considering previous literature reporting a significant impact of exercise on physical self-perceptions and PSW (Fox, 1997; Anshel, Muller, & Owens, 1986; Blackman et al., 1988; Marsh & Peart, 1998). Blackman et al. (1988) demonstrated a positive effect of dance training on the physical self and social self, as measured by the Tennessee Self-Concept Scale, among 18 high school females. A positive effect of exercise on sport related aspects of self-concept, as measured by the Student's Self-assessment Inventory, of fifteen children, ages 6-9 years was also reported (Anshel, Muller, & Owens, 1986).

These effects of exercise on self-perceptions and quality of life may be, in part, due to interventional variants such as program durations (Schmalz et al., 2007) social context (Bruya, 1977; Marsh and Peart, 1988), and physical activity mode (Bruya, 1977; McGowan et al., 1974; Percy et al., 1981). For example, Marsh & Peart (1988) found that girls participating in a fitness program promoting cooperation showed greater improvements in physical self-concept (i.e., physical ability and appearance) compared to those participating on a program focused on competition.

Another reason the exercise intervention may not have impacted self-perceptions or quality of life may be because overall MVPA did not increase as a result of the intervention. A general goal of activity interventions is to increase physical activity levels. By study design, an increase in MVPA among those in the experimental group as a result of the exercise intervention was expected. This is especially true considering participants were instructed to wear the accelerometers for five days at follow-up, one of which included an exercise intervention session for the experimental condition. Contrary to predictions, the intervention demonstrated no effect on MVPA according to the 2 (condition) X 2 (time) ANOVA. This is an important finding in that it demonstrates that exercise interventions do not necessarily result in increased physical activity outside of the intervention. However, it is interesting to note that, according to results of the *t*-tests displayed in Tables 4 and 5, MVPA decreased dramatically among participants in the control group, but not in the experimental group. This suggests that, although the intervention did not result in an increase in physical activity, the intervention was successful in maintaining MVPA among the experimental participants. This finding is important considering the previously documented decrease in physical activity level as children age (Kelder et al., 1994; Strauss et al., 2001; Wolf et al., 1993).

Findings from this study also suggest that exercise alone may not be sufficient for increasing psychological well-being among inactive children. The quality of the experience may also play an essential role. Exercise experiences that promote enjoyment and a sense of success may be critical to elicit changes in well-being. Although the general intent was to structure the exercise to be a positive experience for the children, it is not apparent to what extent it was. This is especially true given that attraction toward physical activity did not change, as was observed in ancillary analyses. Perhaps if steps were taken to emphasize task mastery and promote self-determination or intrinsic fun and excitement (Whitehead and Corbin, 1997), the intervention would have had an impact on GSE, PSW, and/or physical self-perceptions.

Although the exercise intervention did not affect psychological well-being, the total sample demonstrated change over time on several variables. Perceived physical strength, perceived body attractiveness, and perceived physical condition improved significantly across the 16 week period for the entire sample. The change over time seen for these self-perception variables supports the observed instability of self-perceptions among children (Trzesiewski et al., 2003). Additionally, HRQOL school functioning worsened over time across the entire sample. Such change implies that, as inactive children of 8 -11 years develop, a decline in HRQOL school functioning can be expected. Recall that HRQOL school functioning was one of the scales with diminished reliability; this factor may have caused the observed fluctuations. Perceptions on the three other subsets of HRQOL (physical, social, and emotional functioning) were unaffected.

This study also sought to examine whether lean or obese participants had differing responses to the exercise intervention. Past research has consistently shown that overweight and obese children exhibit lower PSW and perceived body attractiveness compared to healthy weight children (French et al., 1995; Pesa et al., 2000; Israel & Ivanova, 2002; Banis & Varni, 1988; Strauss, 1985). In addition individuals exhibiting less positive self-perceptions experience greater improvements after participation in exercise interventions compared to those with more positive self-perceptions (Scully et al. 1998; Fox, 1999; Sonstroem, 1984; Fox, 2000; McGowan, 1974). Therefore, obese participants might show greater improvements in well-being as a result of an exercise intervention compared to healthy weight participants.

Although previous literature demonstrated inconsistent findings regarding an association with BMI and GSE (Banis & Varni, 1988; Braet et al., 1997; French et al., 1995; Kaplan & Wadden, 1986; Mendelson & White, 1985; Sallade, 1973; Strauss et al., 1985; Strauss, 2000; Wadden et al., 1984), research has consistently found that PSW (Banis & Varni, 1988; Mendelson & White, 1985; Strauss, 1985) perceived body attractiveness, and perceived physical condition (Welk & Eklund, 2005) are lower among obese children compared to healthy weight children. Additionally, it has been documented that obese children exhibit far poorer HRQOL compared to healthy weight children (Schwimmer et al., 2003; Pinhas-Hamiel et al., 2006). In fact, Schwimmer et al. (2003) observed obese children to have similar HRQOL to that of children undergoing chemotherapy for the treatment of cancer. Pinhas-Hamiel et al. (2006) report that youth in the most severe obese category had the lowest quality of life in terms of school functioning, compared to other children, suggesting that severity of overweight influences HRQOL school functioning. This finding is similar to the observations in the current study. It is interesting to note, however, that in Pinhas-Hamiel et al. (2006) reported stronger relationships between BMI status and HRQOL physical functioning and HRQOL social functioning than were reported for HRQOL school functioning; these observations were not evident from the current investigation. However, Pinhas-Hamiel et al. (2006) sampled 182 children and adolescents. It is also possible that the inclusion of adolescents in their study impacted the observations greatly enough to demonstrate an association between HRQOL physical functioning, HRQOL social functioning and BMI that may not be present when examining only younger children.

Contrary to predictions, obese children did not show greater improvements in either self-perceptions or quality of life compared to healthy weight participants. This may have been due in part to the lack of differences between obese and healthy weight participants on a majority of baseline self-perception and quality of life related variables. However, on examination, the obese participants in this study indicated lower perceived physical condition at baseline compared to the healthy weight participants. Theoretically, obese participants should have shown greater gains in perceived physical condition as a result of exercise participation given their baseline scores compared to healthy weight participants. However, this was not the case. The exercise intervention did not result in significant changes in GSE, PSW, physical self-perceptions or HRQOL for either the obese or healthy weight participants. This observation may have been due to an imbalance of obese and healthy weight participants in each group. Investigations utilizing a more homogenous sample, in regards to gender and obesity status, or a matched pairs design may lend more understanding of the interaction between weight status, exercise, GSE, PSW, physical self-perceptions, and HRQOL.

Although obese individuals showed decreased quality of life in terms of school functioning, healthy weight participants across the entire sample demonstrated increased perceived body attractiveness, perceived physical condition, and perceived sports competence. It is alarming that the beneficial effects of self-perception development seen among healthy weight children, as well as for the entire sample, were not present among obese children. This lends additional support to the already recognized need for interventions designed to target physical self-perceptions of obese children.

Healthy weight participants also exhibited a significant decrease over time of average minutes of MVPA. Physical activity level among obese participants did not change significantly from baseline to follow-up. It is interesting to consider that a larger proportion of the obese participants were in the exercise condition. The imbalance between obese and healthy weight children in the control and exercise conditions may have affected results. However, these observations suggest that the intervention implemented in the current study was successful in maintaining MVPA among a group of mostly obese youth.

Given the evidence of BMI status, gender, age, and race differences in self-perceptions (French et al., 2004; Banis & Varni, 1988; Sallade, 1973; Strauss et al., 1985; Strauss, 2000; Braet et al., 1997; Mendelson & White, 1985; Pesa et al, 2000; Strameijer et al., 2000; Zametkin et al, 2004; Israel & Ivanova, 2002; McCabe et al., 2001; Swallen et al., 2005; Friedlander et al., 2003; Biro et al., 2006; Davison & Birch, 2001; Ebbeling, 2002;) research designed to examine demographic differences on self-perception development and HRQOL could provide insight for the development of appropriate interventions targeting physical self-perceptions and HRQOL among youth.

To better understand the effect of physical activity on GSE, PSW, physical self-perception and HRQOL among individuals of varying ages, and BMI, a more specific portrait of such constructs throughout life, attributable to psychological developments, should be sought. By observing the natural fluctuations in these constructs over time for each age group and BMI classification, investigators may be able to provide information regarding the development of psychological constructs contributing to one's well-being. From such information, programs targeting both physical and psychological variants with the aim of promoting healthy living may be designed and implemented for individuals of varying BMI in all stages of life. Examinations of the effects of time on these GSE, PSW, physical self-perceptions, and HRQOL should be examined with varying durations between testing and with several test administrations to paint a more complete picture of the development of these constructs and their contribution to each other.

In terms of future research examining the effects of exercise on self-perceptions and quality of life, it is recommended that future exploration include larger numbers of participants. Future researchers might also examine the extent to which each of the recommended characteristics of a successful exercise intervention targeting self-esteem and physical self-perceptions contributes to self-esteem and quality of life gains (Whitehead and Corbin, 1997). A closer examination of the dose/response relationship between exercise and gain in GSE, PSW, physical self-perceptions, and HRQOL with specific regard to mode, duration, and intensity of exercise is also warranted. Lastly, future researchers might consider the use of a perceived importance instrument (Harter, 1986), as it may provide more evidence regarding the development of self-perceptions. According to self-concept theory, areas of high importance to an individual have greater influence on overall self-esteem than areas of low importance. Theoretically, the use of a perceived importance scale could provide useful information about specific contributors to higher level self-perception, and their response to external stimuli, such as physical activity, among populations of varying age.

Chapter 6: Conclusion

Overall, the current investigation implies that MVPA level is not associated with GSE, PSW, physical self-perceptions and HRQOL among inactive 8-11 year olds. Additionally, basic exercise interventions may be insufficient to increase MVPA level, and improve GSE, PSW, physical self-perceptions, and HRQOL among inactive healthy weight or obese children. Lastly, exercise interventions may be an important component in efforts to maintain MVPA level among youth of varying BMI.

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Appendix A.
IRB Approval Form

From: 07/10/2009 00:07 #448 P.002/003

EAST CAROLINA UNIVERSITY

University and Medical Center Institutional Review Board
East Carolina University • Brody School of Medicine
600 Moye Boulevard • Old Health Sciences Library, Room 1L-09 • Greenville, NC 27834
Office **252-744-2914** • Fax **252-744-2284** • **www.ecu.edu/irb**
Chair and Director of Biomedical IRB: L. Wiley Nifong, MD
Chair and Director of Behavioral and Social Science IRB: Susan L. McCammon, PhD

TO: Robert Hickner, PhD, Department of EXSS & Physiology, ECU

FROM: UMCIRB

DATE: July 8, 2009

RE: Full Committee Approval for Continuing Review of a Research Study

TITLE: Reduction in CVD Risk in Children Through Physical Activity

UMCIRB #05-0384

The above referenced research study was initially reviewed by the convened University and Medical Center Institutional Review Board (UMCIRB) on **9/21/05.** The research study underwent a subsequent continuing review for approval on **7/8/09** by the convened UMCIRB. The UMCIRB deemed this **NIH/NIDDK** sponsored study **more than minimal risk** requiring a continuing review in **12 months.** Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The investigator must adhere to all reporting requirements for this study.

The above referenced research study has been given approval for the period of **7/8/09** to **7/7/10**. The approval includes the following items:

- Continuing Review Form (dated 6/24/09)
- Protocol Description from Grant Application (dated 3/4/05)
- Protocol Summary (dated 7/26/07)
- Informed consent (dated 7/26/07)
- Minor Assent (dated 7/26/07)
- YRBS (dated 8/1/05)
- Leisure Time Exercise Questionnaire (version 8/1/05)
- 30-Day Physical Activity Recall (version 8/1/05)
- 3-Day Food Record w/Instructions
- Medical History Form
- Physical Activity Logbook
- Peds QL (ver. 4.0)
- Food Frequency Questionnaire
- Physical Perception and Attraction to Physical Activity Scale
- Flyer (dated 1/8/09)

The following UMCIRB members were recused for reasons of potential for Conflict of Interest on this research study:
S. McCammon

NOTE: The following UMCIRB members with a potential Conflict of Interest did not attend this IRB meeting:
R. Hickner

The UMCIRB applies 45 CFR 46, Subparts A-D, to all research reviewed by the UMCIRB regardless of the funding source. 21 CFR 50 and 21 CFR 56 are applied to all research studies under the Food and Drug Administration regulation. The UMCIRB follows applicable International Conference on Harmonisation Good Clinical Practice guidelines.

Appendix B.

Means and Standard Deviations of the Outcome Variables for Both Groups at Baseline and Follow-Up

	Experimental Group (*N* = 26)				Control Group (*N* = 14)			
	Pre		Post		Pre		Post	
Subscale	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
MVPA[a]	40.34	27.34	39.48	30.77	57.66	28.65	38.39	29.17
GSE[b]	3.50	.54	3.54	.52	3.44	.52	3.63	.43
PSW[c]	3.32	.73	3.41	.52	3.47	.69	3.56	.50
Perceived physical strength	2.99	.62	3.21	.72	3.38	.55	3.50	.62
Perceived body attractiveness	2.68	.85	2.93	.81	2.98	.57	3.38	.49
Perceived physical condition	2.93	.70	3.21	.64	3.21	.75	3.37	.71
Perceived sport competence	3.30	.51	3.36	.66	3.48	.57	3.50	.49
Liking of games and sports	3.51	.57	3.67	.55	3.68	.32	3.73	.55
Liking of vigorous exercise and exertion	2.96	.59	3.19	.55	3.30	.53	3.30	.50
HRQOL school functioning	.78	.58	1.11	.73	.65	.46	.93	.66
HRQOL social functioning	.78	.83	.76	.67	.49	.48	.50	.35
HRQOL emotional functioning	1.03	.72	1.06	.82	.71	.63	.96	.65
HRQOL physical functioning	.79	.60	.74	.65	.40	.35	.52	.41

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).

Appendix C.

Means and Standard Deviations of the Outcome Variables for Both Groups at Baseline and Follow-Up Listed Separately for Obese and Healthy Weight Participants

	Experimental (N = 18)				Control (N = 5)			
	Pre		Post		Pre		Post	
Subscale	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Obese				
MVPA	38.01	27.13	46.29	33.08	51.69	42.94	29.83	28.10
GSE	3.46	.54	3.45	.52	3.57	.38	3.92	.18
PSW	3.25	.75	3.32	.52	3.53	.45	3.83	.20
Perceived physical strength	2.88	.58	3.12	.74	3.50	.37	3.70	.42
Perceived body attractiveness	2.37	.70	3.66	.77	2.97	.78	3.47	.55
Perceived physical condition	2.90	.64	3.09	.60	3.30	.65	3.43	.30
Perceived sport competence	3.28	.48	3.27	.70	3.67	.49	3.63	.22
Liking of games and sports	3.50	.52	3.63	.60	3.80	.21	3.95	.11
Liking of vigorous exercise and exertion	2.88	.51	3.05	.56	3.68	.29	3.63	.38
HRQOL school functioning	.74	.58	1.09	.74	.28	.39	.80	.47
HRQOL social functioning	.93	.92	.90	.74	.40	.41	.48	.52
HRQOL emotional functioning	1.13	.72	1.08	.90	.56	.67	1.17	.98
HRQOL physical functioning	.91	.61	.82	.69	.40	.26	.51	.37
				Healthy weight				
MVPA	45.58	28.93	24.16	18.33	60.98	19.42	43.14	30.28
GSE	3.61	.56	3.72	.51	3.37	.59	3.46	.45
PSW	3.46	.71	3.62	.47	3.42	.81	3.41	.55
Perceived physical strength	3.23	.68	3.44	.69	3.32	.64	3.39	.71
Perceived body attractiveness	3.27	.85	3.54	.53	2.98	.47	3.33	.48
Perceived physical condition	3.02	.87	3.48	.67	3.16	.83	3.33	.87
Perceived sport competence	3.33	.62	3.56	.60	3.26	.58	3.43	.58
Liking of games and sports	3.53	.71	3.78	.41	3.61	.36	3.61	.66
Liking of vigorous exercise and exertion	3.13	73	3.52	.38	3.08	.52	3.13	.48
HRQOL school functioning	.86	.62	1.15	.75	.850	.38	1.00	.76
HRQOL social functioning	.43	.47	.45	.37	.53	.42	.51	.25
HRQOL emotional functioning	.80	.70	1.03	.67	.80	.63	.84	.40
HRQOL physical functioning	.51	.48	.55	.54	.41	.40	.52	.46

[a]Average minutes of moderate to vigorous physical activity per day (MVPA). [b]Global self-esteem (GSE). [c]Physical self-worth (PSW).