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UNIVERSITY OF MIAMI

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Objectives: Prior research indicates that minority youth are more at risk for developing obesity, and that obesity is associated with several health complications as well as significant healthcare costs. The current study addressed the role of symptoms of internalizing disorders with regards to obesity in primarily ethnic minority fourth and fifth graders. In addition, this study was the first to expand upon prior research by determining whether symptoms of depression, anxiety, and social anxiety were associated with BMI at six month follow up in this age group, and whether gender moderated the relationship of internalizing symptoms and BMI. Finally, the current study also determined whether physical activity and diet mediated the relationship between depression, anxiety, social anxiety and BMI. Method: This study had a two-wave prospective design, with baseline and 6 month follow up data collection. Ninety-three children were recruited in fourth (n = 53, 56%) and fifth (n = 40, 43%) grades at two public elementary schools. Research staff recruited children via letters sent home to the parents. Parents completed consent forms and demographic data. Research staff collected height, weight, and questionnaire data from youth during the spring or fall of the

academic year, dependent upon school, at baseline (May 2011 for Time 1 school 1; November 2011 for Time 1 school 2) and collected height and weight at six month follow up (November 2011 for Time 2 school 1; May 2012 for Time 2 school 2). The sample was 46% girls and youth were from predominantly ethnic minority backgrounds (76% Hispanic). At Time 1, 28% (n = 26) of children were considered overweight and 19% (n = 18) were obese. At time 2, 33% (n = 31) of children were considered overweight and 25% (n = 23) were obese. Questionnaires included the Children's Depression Inventory-Short Form; Revised Children's Manifest Anxiety Scale, Second Edition Short Form; the Social Anxiety Scale for Children-Revised; several diet and physical activity items from the Youth Risk Behavior Survey; and the Pubertal Development Scale. Results: Hierarchical regressions examined whether: 1) symptoms of depression, anxiety, and social anxiety were concurrently associated with BMI; 2) depressive, anxious, and socially anxious symptoms predicted later BMI at time 2; 3) internalizing symptoms predicted a change in BMI z-scores; 4) internalizing symptoms predicted overweight/obese status; 5) physical activity and diet mediated these relationships; and 6) gender moderated the prospective relationship between internalizing symptoms and BMI. Findings revealed that the shared variance between internalizing symptoms was associated with BMI at Time 1, $R^2\Delta$= .08; $F\Delta$ (3, 86) = 3.06, p = .03, but no internalizing symptoms uniquely predicted BMI. The predictive relationships between symptoms of depression and anxiety and BMI at Time 2 were not significant, nor were the relationships between internalizing symptoms and change in BMI or likelihood of being overweight or obese. The mediation analyses were not able to be adequately tested due to lack of significant findings in the prospective analyses and because the potential

mediators were not related to children's BMI. Finally, there was a significant interaction of gender on the relationship between social anxiety and BMI at Time 2, $R^2\Delta = .06$; $F\Delta$ (3, 78) = 4.75, $p = .004$. Further examination of simple slopes illustrated that, for girls only, social anxiety symptoms were predictive of BMI at Time 2, SASCR ß = .35, $p = .001$, such that higher social anxiety symptoms were associated with higher BMI at Time 2. Discussion: These results extend prior research in this field by demonstrating that, as a whole, internalized distress or negative affect is related to children's BMI, as it was the shared variance between depression, anxiety, and social anxiety that was associated with children's BMI. Furthermore, findings from the prospective analyses revealed relationships between social anxiety and BMI for girls in a primarily Hispanic sample of children. Further exploration of the relationships between depression, social anxiety, and general anxiety, or general negative affect, and BMI in minority children is needed to determine the nature of the prospective relationships (i.e., whether BMI predicts later internalizing symptoms or internalizing symptoms predict to later BMI). Also, an examination of potential underlying mechanisms (e.g., physical activity) would further inform these relationships and assist in identification of potential targets for intervention. Varied measurement strategies (e.g., daily recalls, interviews, accelerometry) for evaluating these underlying health behaviors (i.e., diet, physical activity) are needed to better evaluate the potential contributing mechanisms. Current findings underscore the importance of utilizing screeners of internalizing symptoms or general negative affect to identify children who may be at risk for becoming overweight. Also, findings highlight the importance of measuring social anxiety as a potential means of identifying girls who may be at risk for weight concerns or for developing obesity. Efforts to reduce internal

distress in youth, and social anxiety specifically in girls, may have a positive health benefit and requires further exploration.

TABLE OF CONTENTS

List of Figures and Tables

Tables

Figures

Chapter 1: INTRODUCTION

Childhood overweight and obesity has increased significantly among youth in the United States (Ogden & Carroll, 2010) and is associated with high risk of continued obesity and metabolic syndrome into adulthood (Sun et al., 2008). Past literature has highlighted the link between obesity and health problems such as metabolic syndrome, insulin resistance, diabetes, heart disease, and psychological problems (Grundy, 2000). Further, previous research has discovered significant costs to the healthcare system in the United States due to obesity complications (Wang, Li, & Dietz, 2002).

Prevention of these health complications should begin by prevention of obesity in childhood, and research indicates certain child populations are more at risk for developing obesity. Past research has indicated that Hispanic minority children are more likely to be obese than their non-Hispanic counterparts (Ogden et al., 2006), which places them at risk for several health concerns. Reducing obesity in these children would decrease their risk of later health complications and decrease public health costs associated with obesity-related health problems. However, relatively little research has targeted obesity prevention in minority youth.

Prior research has indicated several modifiable risk factors related to unhealthy lifestyles and obesity. Several studies examined the link between obesity and depression and anxiety among adolescents (Reeves, Postolache, & Snitker, 2008; Anderson, Cohen, Naumova, Jacques, & Must, 2007; Pine, Cohen, Brook, & Coplan, 1997), and this study seeks to replicate these findings with a younger sample. In addition, there is a paucity of studies in youth examining the relationships between depression, anxiety, and obesity. Although prior studies with adolescents indicated a link between depression and obesity

(Goodman & Whitaker, 2002), and between anxiety and obesity (Anderson, Cohen, Naumova, & Must, 2006), these associations have not been examined among pre-adolescent children. This study will be the first to examine the associations between symptoms of depression and anxiety, and weight in a younger sample of primarily ethnic minority children.

The sections below provide relevant background information for the proposed study. Specifically, information is presented regarding a) weight and obesity in youth, b) the relationship between depression and weight, c) anxiety, social anxiety, and weight, d) potential mediators of the relationship between symptoms of depression, anxiety, social anxiety, and weight, including physical activity and diet; and e) the role of other demographic variables including gender. Finally, the specific study aims and hypotheses are explained in detail.

Epidemiology and Course of Weight Gain and Obesity in Youth

Obesity has become an increasing health problem among youth in the United States. Prevalence rates of overweight (BMI>95th percentile) in children have increased significantly between 1976-1980 and 2007-2008. For example, rates have increased from 5 to 10.4% among 2-5 year olds; from 6.5 to 19.6% among 6-11 year olds; and from 5 to 18.1% among 12-19 year olds (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Ogden, Carroll, & Flegal, 2008).

This increase is disturbing because in addition to developing health problems related to obesity, there are other costs to the health system in the United States. Trasande, Liu, Fryer and Weitzman (2009) analyzed a sample of youth who had been hospitalized for obesity-associated reasons and found that the number of hospitalizations

doubled from 1999 to 2005, and that obesity related costs increased from $125.9 million to $237.6 million between 2001 and 2005.

Increased prevalence rates and costs to the healthcare system highlight the need for more research with younger school-aged children in order to create early interventions and prevent later complications. This developmental age (i.e., nine years) also represents the lower limit of valid self-reports, which is the typical form of measurement for this type of research (e.g., Merrell, 2006).

Ethnicity

Childhood obesity is also a significant concern specifically among ethnic minority populations. Obesity rates are significantly higher among ethnic minority populations compared with non-minorities. For example, obesity prevalence rates in the NHANES 2007-2008 study indicated that the prevalence of obesity was significantly higher among Mexican-American adolescent boys (26.8%) than among non-Hispanic white adolescent boys (16.7%); obesity prevalence rates for non-Hispanic black girls (29.2%) were higher than non-Hispanic white girls (14.5%) (Ogden & Carroll, 2010). Among adults, obesity prevalence rates in the NHANES 2007-2008 study indicated that the prevalence of obesity was highest among non-Hispanic Black Americans (44.1%), followed by Hispanic Americans (37.9%), with White, non-Hispanic adults having the lowest prevalence rates (32.8%) (Flegal, Carroll, Ogden & Curtin, 2010).

Internalizing Symptoms and Weight

Depressive Symptoms and Weight. A first goal of this study was to examine the relationship between depressive symptoms and weight in primarily Hispanic children, 9 to 11 years old. Previous research has demonstrated a link between higher weight and

greater depressive symptoms among youth and adults. For example, chronic obesity has been associated with depressive disorders (measured via structured clinical interview) in boys (Mustillo et al., 2003). Further, among non-obese primarily Caucasian youth ages 8-18 years, participants diagnosed with Major Depressive Disorder or an anxiety disorder (i.e., generalized anxiety, separation anxiety, or social phobia) after a structured clinical interview had higher concurrent and prospective BMI percentiles than those without a clinical diagnosis (Rofey et al., 2009). The current study extended prior research by determining whether greater symptoms of depression were associated with higher weight in ethnic minority children.

There is a paucity of research with youth that examines whether depression is prospectively related to obesity. Goodman and Whitaker (2002) found that self-report measure of depression predicted the development and persistence of obesity in a large sample of primarily White adolescents (7-12th graders); adolescents who were depressed at baseline were approximately twice as likely to be obese at follow-up. Similarly, in a sample of 496 primarily Caucasian adolescent girls (11-15 years), depressive symptoms measured via diagnostic interview predicted obesity onset (Stice, Presnell, Shaw, & Rohde, 2005). Also, diagnosis of depression via structured clinical interview in youth ages 6-17 years was associated with a higher body mass index (BMI) later in adulthood (Pine, Goldstein, Wolk, & Weissman, 2001). These three studies provided preliminary evidence that depressive symptoms may be linked with later obesity in youth, but no studies have examined primarily ethnic minority children.

Although there is a lack of research with children, there have been several studies with adolescent or adult populations that supported a prospective link between depression

and obesity. For example, diagnosis of major depression in adolescents predicted a higher BMI in adult life compared to those who had not been depressed (Pine, Goldstein, Wolk, & Weissman, 2001). Strine et al. (2008) found that adults with current depressive symptoms and lifetime depressive or anxious symptoms were significantly more likely to be obese than those who were not depressed or anxious. There is also some evidence for a gender effect, with females more likely to exhibit this association than males (Richardson et al., 2003). Thus, there are several studies with adults that highlight the association between depression and later obesity.

In summary, the present study built on this earlier work by examining the concurrent relationship between weight, obesity, and depressive symptoms in a sample of elementary school children.

Further, many prior studies have examined nonminority children, but the current study was the first to examine whether depressive symptoms were prospectively associated with weight in a sample of primarily Hispanic elementary school children.

Anxiety Symptoms and Weight. A second study goal was to examine the association between symptoms of general and social anxiety and obesity in children. The relationship between anxiety and weight has been identified in adolescents and adults. Among primarily Caucasian females, ages 9-18 years, Anderson and colleagues (2007) found a relationship between obesity and later diagnosed anxiety disorders, excluding those who had a diagnosed anxiety disorder at the beginning of the study. Further, Rofey and colleagues (2009) found that, among primarily Caucasian non-obese youth ages 8-18 years, participants with Major Depressive Disorder or an anxiety disorder (i.e., generalized anxiety, separation anxiety, or social phobia) had higher concurrent and

prospective BMI percentiles than those without a clinical diagnosis. Thus, there is some evidence of a concurrent relationship between anxiety and obesity, with higher rates of anxiety associated with higher BMI in nonminority youth. The current study examined the concurrent relationship between symptoms of trait anxiety and obesity in a sample of primarily minority children.

Further, this study sought to examine whether symptoms of anxiety were prospectively related to weight or obesity. One potential explanation for this prospective association is that individuals who experience anxious symptoms tend to eat more (e.g., emotional eating) and eat less healthy than those who do not have anxiety symptoms. For example, higher self-report of symptoms of anxiety and depression was concurrently associated with emotional eating in youth ages 8-18 years (Goossens, Braet, Van Vlierberghe, & Mels, 2009). Anderson, Cohen, Naumova, and Must (2006) studied a sample of primarily Caucasian youth beginning in 1983 when they were ages 9-18 years, and then followed them up in 1985-86, 1991-94, and 2001-03. They found that anxiety disorders (diagnosed via diagnostic interview) were associated with a higher BMI z-score compared with non- anxious females; female depression was associated with a gain of .09 BMI z-score units per year. In males, they noted that childhood depression was associated with a lower BMI z-score, while anxiety disorders were not significantly associated with BMI.

Social anxiety has also been highlighted as a factor in relation to obesity or overweight. Social anxiety involves a fear of social situations, including fear of negative evaluation (i.e., teasing, bullying, fear of peer rejection), and social avoidance and distress specific to new situations as well as general social distress and avoidance (La

Greca & Stone, 1993). Fear of negative evaluation was associated with less physical activity and higher BMI z-scores in a cross-sectional analysis of first and fifth graders in Switzerland (Hartmann et al., 2010). Further, in a cross-sectional sample of adults, obesity and overweight predicted increased risk of diagnosis of social phobia for women (Barry, Pietrzak, & Petry, 2008).

Based on the above, it is important to examine the role of anxiety and social anxiety in association with weight and the development of obesity among children, so that interventions may be implemented as early as possible to alleviate some of the health concerns and healthcare costs associated with obesity. The present study addressed this issue by examining the concurrent relationship between anxiety and social anxiety symptoms and obesity. Further, although many prior studies examined primarily nonminority children, the current study also determined whether there was a prospective association between symptoms of anxiety and social anxiety and later BMI in a sample of predominantly Hispanic youth.

Explaining the Results: Physical Activity and Diet

If the aforementioned relationships between internalizing symptoms and BMI were significant within the current sample, it would be important to identify possible mediating variables. Specifically, physical activity and diet were two potential candidates that were examined, given the associations between physical activity, diet, and BMI.

Due to the influence of depression and anxiety on children's levels of physical activity, one mediator of interest was physical activity and sedentary behavior. Sallis, Prochaska, and Taylor (2000) conducted a review of 108 studies and found that higher levels of depression were associated with lower levels of physical activity in a sample of

youth ages 3-18 years old. Further, lack of interest in activities is a symptom of depression, which could manifest in decreased interest and participation in physical activity resulting in increased weight. Also, anxious/depressed symptoms in boys and withdrawn/depressed symptoms in girls on the Youth Self-Report have been associated with higher levels of physical inactivity in a sample of 15-16 year olds in Finland (Kantomaa, Tammelin, Ebeling, & Taanila, 2008). Insufficient levels of vigorous physical activity also have been associated with higher levels of body mass index (BMI) for adolescent boys and girls (Patrick et al., 2004). Thus, both low physical activity and high inactivity (i.e., sedentary behavior) were examined in the current study as potential links between higher symptoms of depression, anxiety, and social anxiety, and higher children's BMI in a sample of primarily Hispanic children.

In addition, dietary intake is another potential mediator of the association between depression and anxiety and obesity/overweight in youth that was examined in this study. Self-report of depression using the Children's Depression Inventory was strongly correlated with disordered eating (i.e., binge-purge cycling) behaviors in 5th to 12th graders (Neumark-Sztainer & Hannan, 2000). This is problematic because binge eating has been associated with weight gain over time in adolescent girls (Stice, Presnell, & Spangler, 2002). Also, there is a preference for high energy-dense foods in emotional eating (i.e., eating in response to negative emotions) (Nguyen-Michel, Unger, & Spruijt-Metz, 2007) and eating too much high energy-dense foods can lead to weight gain or obesity. Also, among overweight youth, increased emotional eating (i.e., eating in response to negative emotions) was associated with self-report of higher trait anxiety symptoms and depression symptoms (Eddy et al., 2007). Thus, it is possible that

depression, anxiety, and social anxiety could lead to dietary problems, which in turn could contribute to the development of excess weight. The current study expanded prior research by examining the role of dietary intake as a potential mediating variable between symptoms of depression, anxiety, and social anxiety, and weight among primarily ethnic minority children.

The Role of Demographic Variables

As a final study goal, the current study also examined various demographic variables that have been associated with overweight or obesity: socioeconomic status, marital status, child age, ethnicity and gender. Lower socioeconomic status has been associated with higher levels of obesity in developed countries (Ball & Crawford, 2005), and thus was considered as a control variable in this study. Older children and children of divorced parents tend to have higher BMIs (Yannakoulia et al., 2008), and those variables were also considered as possible control variables in this study. Gender is also an important factor to consider, as females are at greater risk for developing anxiety and depressive disorders at earlier ages than males (Piccinelli & Wilkinson, 2000). Further, given the aforementioned gender differences between depression, anxiety, and social anxiety, and their association with weight, gender was examined as a moderating variable between internalizing symptoms and later BMI. Furthermore, puberty is a time when children tend to gain weight (Russell-Mayhew, 2005), and thus it was important to measure and consider pubertal status when evaluating children's weight by controlling for differences between children who have begun puberty and those who have not. Given that this age range is a time of significant changes for children (e.g., puberty), the current study sought

to examine the prospective associations over a six month period as opposed to a one year or longer timeframe that has been utilized in studies with adolescents and adults.

Also, as previously explained, obesity and overweight is more prominent in those with minority status than those of nonminority status (Flegal, Carroll, Ogden, & Curtin, 2010; Ogden & Carroll, 2010). Further, previous studies of prevalence rates of obesity in Hispanic youth have focused primarily on Mexican-American children (Ogden & Carroll, 2010), while the current study examined a primarily Hispanic sample from various backgrounds. As mentioned, prior studies examined internalizing symptoms in relation to obesity in primarily nonminority samples (e.g., Goodman & Whitaker, 2002); this study was the first known study to examine these relationships within a primarily Hispanic sample. Therefore, it was important to consider ethnic differences and the potential impact of ethnicity on analyses.

Study Goals

The current study examined the relationship between symptoms of depression, anxiety, and social anxiety, and BMI in a sample of primarily Hispanic children, ages 9 to 11 years. The specific aims of this research were as follows:

1) To determine whether children's body mass index (BMI z-scores) was concurrently related to symptoms of depression, anxiety, and social anxiety in predominantly Hispanic children (see Figure 1). It was hypothesized that higher BMI z-scores would be associated with higher levels of depressive, anxiety, and social anxiety symptoms.

2) To expand upon previous data by determining whether symptoms of depression, anxiety, and social anxiety were prospectively associated with weight in children (see Figure 1). Specifically, it was hypothesized that higher levels of depression, anxiety, and social

anxiety (i.e., internalizing) symptoms at Time 1 would be associated with higher BMI z-scores at Time 2, controlling for BMI at Time 1.

3) To determine whether symptoms of depression, anxiety, and social anxiety were prospectively associated with change in BMI (see Figure 1). Specifically, it was hypothesized that higher levels of depressive, anxious, and socially anxious symptoms at Time 1 would be associated with increased BMI over time (i.e., from Time 1 to Time 2).

4) To examine whether symptoms of depression, anxiety, and social anxiety were prospectively associated with being overweight or obese (i.e., a dichotomous obese/overweight variable) in children (see Figure 1). Specifically, it was hypothesized that higher levels of internalizing symptoms at Time 1 would be associated with an increased likelihood of being overweight or obese at Time 2.

5) To examine whether physical activity and diet mediated the relationship between symptoms of depression, anxiety, social anxiety, and children's weight (provided that these associations are found) (see Figure 2). Specifically, it was hypothesized that higher levels of symptoms of depression, anxiety, and social anxiety would be associated with higher levels of unhealthy eating and inactivity (i.e., lower physical activity and higher sedentary activity), thus contributing to increased BMI z-scores.

6) To examine whether gender had a moderating effect on the above analyses (see Figure 3). Specifically, it was hypothesized that the prospective association between symptoms of depression, anxiety, and social anxiety would differ by gender such that relationships would be stronger for girls than for boys.

Chapter 2: METHOD

Participants

The participants for this study were 93 primarily Hispanic children (76%; 46% girls) aged 9-11 years, *M* age = 9.92 ± .68 years who were attending fourth and fifth grade at two public elementary schools in Miami-Dade County. (See Table 1 and 2 for demographic information.) The schools served children from a mostly Hispanic low-income population, a population that is at risk for development of obesity. Recent data on the number and race/ethnicity of children (grades K-5) enrolled at the two study schools is shown in Table 3.

Study inclusion criteria included children: 1) from fourth or fifth grade, 2) with parental consent, and 3) that were able to speak, read, and write English. Exclusion criteria were the presence of chronic disease (e.g., diabetes, cystic fibrosis, liver or renal disease), mental retardation, or a diagnosed endocrine cause for obesity.

In terms of their countries of origin, children were primarily from the United States (66.7%) or Cuba (14%). Other children were from Honduras or Mexico (2% each), and the remainder were from various other countries (e.g., <2% each from Argentina, Chile, etc.). Most children were of minority status (*n* = 74, 80% of the sample).

Children's BMI z-scores at Time 1 ranged from -1.54 to 2.94, *M* BMI = .81 ± 1.17; therefore, children's average BMI at Time 1 was within the normal range. At Time 1, approximately 28% of children (*n* = 26) were considered overweight and 19% (*n* = 18) were considered obese. Children's BMI z-scores at Time 2 ranged from -1.31 to 2.64, *M*BMI = 1.06 ± 1.03; therefore, children's average BMI at Time 2 was within the Overweight range. At Time 2, 33% (*n* = 31) of children were considered overweight and 25% (*n* = 23) were considered obese. Table 4 provides a more detailed explanation of change in BMI over time.

Most parents who participated were mothers (88%) and many parents had only a high school education or less (51.7% mothers, 55.7% fathers). Mother's BMI z-scores at Time 1 ranged from 17.16 - 43.89, *M*BMI = 26.49 ± 5.38; therefore, the average BMI for mothers was within the Overweight category. Approximately 30% of mothers in the sample were overweight (i.e., a BMI of 25-29.9) and 24% were obese (i.e., a BMI of 30 or higher). Approximately 47% of the sample reported a total annual household income less than 25,000 dollars. Approximately half of parents in the sample were married (*n* = 44.47%)

Procedure

Children attending fourth and fifth grade were recruited for participation via letters describing the study and consent forms sent home to parents. The teacher at each school with the most returned forms, either consenting or not, received a $25 gift card (redeemable at local office supply stores). Further, names of students at each school who completed the assessments were entered into a raffle to receive one $25 or $50 Visa gift cards at each school, at each time point for data collection.

Included with the written consent forms for parents was the demographic questionnaire (i.e., questions concerning demographic variables and self-report of parent height and weight). After written consent was obtained from the parents, the primary study coordinator, a doctoral candidate, coordinated times with the schools for data collection. Baseline (Time 1) data collection occurred in May 2011 for children in school one (*n* = 25, 27% sample) and in November 2011 for school two (*n* = 68, 73% of sample), based on when access was allowed to the schools. At baseline, children signed assent forms and completed packet of questionnaires, and the research team measured height and weight. One member of the research team read questions aloud to children, and other members of the team walked

around the classroom to answer questions and assure children were following along. Once children completed questionnaires, research staff individually and confidentially (i.e., not where other students could obtain their information) measured their height (via stadiometer) and weight (via the Health o Meter HDL820-18 Digital Scale with LCD). Research staff conducting the study included two trained Bachelor's level research associates and a doctoral student.

Six months post-baseline (Time 2), during November 2011 for school one and May 2012 for school two, the research team returned to the schools to obtain measures of height and weight. These measures were conducted in the same manner as at Time 1.

Subject participation and retention. This study was reviewed and approved by the University of Miami Institutional Review Board. All study participants signed informed consent and assent; parents signed informed consent and children signed assent forms, according to protocol approved by the University of Miami Institutional Review Board and the Miami-Dade County Public Schools Research Review Board.

A total of 500 recruitment letters explaining the study were sent out to parents at the two study schools; 42% (n = 209) of forms were returned. Of those forms returned, 55% (n = 114) of the parents consented to the study, for an overall participation rate of 23% (i.e., 114 out of 500). Of those who consented to the study, 6% (n = 7) were ineligible due to child speaking only Spanish and 17% (n = 12) were missing either all parent or child data due to various reasons (e.g., child absent during data collection, unable to obtain parent questionnaire data, child moved to a new school). A total of 93 participants had most data completed, and their data was used in the current study analyses. These participants' data did not differ from those with missing data on any of the primary demographic variables.

In a six-month study with low-income children, it was difficult to retain all participants. Attrition from Time 1 to Time 2 was small (n = 11, 12%). Those with complete data were slightly younger than those who were missing data at Time 2 (M_{age} complete = 9.83 ±.63; M_{age} missing = 10.64 ±.67). A number of strategies were employed to enhance subject participation; raffle tickets for participation were provided to teachers and students and these tickets were entered into a raffle to win gift cards. Finally, we only recruited children from families who indicated they did not plan to move within the school year.

Measures

Children were evaluated at Time 1 and again six months later (Time 2). The measures for this study include assessments of demographic, anthropometric, psychosocial, and behavioral variables, as detailed below. Measures and forms given to parents were available in English and Spanish. Measures and forms given to children were available only in English. By the fourth grade, children in the public schools usually have a basic command of the English, which allowed them to complete the study forms. Seven potential participants for the current study were ineligible due to being monolingual in Spanish. Questionnaires were administered at Time 1 only; height and weight were collected at Time 1 and Time 2. Estimated completion time for these measures was approximately 30 minutes.

Translation of measures. Due to the large number of Spanish-speaking parents in this study, all parent measures, including the parent letter, parental consent forms, the demographic forms, and the parent version of questions regarding child's diet and physical activity, were translated into Spanish. These measures were translated using a forward and back-translation by Spanish-translators who were approved by the University of Miami Internal Review Board.

Demographic variables (Appendix A). These variables included age, gender, ethnicity, and history of the children's health problems (including organic problems that could affect weight), geographic origins of ethnic status, parental education and occupation, parent height and weight, marital status, total annual household income range, and intent to move within the next year. Child ethnicity (i.e., Hispanic or non-Hispanic) was obtained from both schools while information about specific race (i.e., White, Black, and Asian) was only available for School 2. This information was obtained by means of a questionnaire given to the parents along with the consent form.

BMI percentiles/obesity. Several measures were used to assess children's body composition, including height (by stadiometer), weight (by the Health o Meter HDL820-18 Digital Scale with LCD), and body mass index (BMI; weight in kg/height in meters squared). BMI was transformed to z-scores based upon national norms for statistical analyses (Children's Nutrition Research Center at Baylor College of Medicine, 2012). Researcher staff physically measured the height and weight of each participating child at each of the two time points. The current study utilized: a) BMI z-score as a continuous measure of children's weight, b) BMI z-score of 1.00-1.99 as an indicator of overweight and a BMI z-score of 2.00 and above as an indicator of obesity (per World Health Organization 2012 recommendations), and c) change in BMI z-score from Time 1 to Time 2 .

Pubertal Development Scale (Peterson, Crockett, Richards, & Boxer, 1988; Appendix B). This measure was used to assess puberty in children. This 5-item measure uses a Likert-type scale to determine pubertal status, and was completed by youth along with other study measures. Puberty has been associated with weight gain in youth

(Russell-Mayhew, 2005), thus it was important to identify those children who had begun puberty, so it could be controlled for in the statistical analyses. Sample items included: "Development of body hair…" and "My period…" Scores are as follows: 1= no development, 2= beginning development, 3 = additional development and 4 = development already past, such that higher scores indicate higher stages of puberty. A total score was obtained by summing the scores across the 5 items, then dividing by 5 to preserve the original metric.

This scale demonstrated good internal consistency, $\alpha = .68$ to .83, and validity by comparison to interviewer ratings, $r = .41$ to .79, in a slightly older sample of primarily White sixth-through eighth- graders(Peterson, Crockett, Richards, & Boxer, 1988). This scale was also validated in slightly older samples of children (Robertson et al., 1992). Past research has also indicated that self-assessed pubertal status via the Pubertal Development Scale is a good proxy for physician physical ratings (Bond et al., 2006). This measure was completed by youth at Time 1.

However, in this study, all but three children reported having begun puberty; no significant differences on primary study variables were noted between these three participants and the other study participants. Therefore, this variable was not considered in the subsequent analyses. Mean total scores for boys was 1.91 ± .53 and the mean total score for girls was 1.86 ± .52.

Children's Depression Inventory- Short Form (CDI-SF; Kovacs, 1992; Appendix C). This widely used scale assessed children's depressive symptoms. The CDI-S is reliable and valid for children from 7to 18years of age, and has been used with various populations. This 10-item scale includes items such as: "I am sad many times" and "I feel

like crying many days." Youth can respond by choosing one of three graded response options increasing in severity from 0 to 2. Children's scores are summed across items and higher scores indicate higher levels of depressive symptoms. T-scores of 70 and higher are within the Very Elevated range, T-scores of 65-69 are within the Elevated range, T-scores of 60-64 are within the High Average range, and T-scores below 60 are within the Average or Lower range. T-scores of 65 or higher represented clinically significant levels of symptoms of depression. This scale has demonstrated good test-retest reliability, r = .74 -.83, and good internal consistency, α = .71 - .89 (Kovacs, 1992). Also, there was a high correlation with the original full-scale Children's Depression Inventory, r = .89 (Kovacs, 1992). This measure was completed by children at Time 1.

"What I Think and Feel" Revised Children's Manifest Anxiety Scale: Second Edition, Short Form Total Anxiety (RCMAS-2 SF-TOT; Reynolds & Richmond, 2008; Appendix D*).* This widely used scale assessed symptoms of trait anxiety in youth. This 10-item scale includes items such as: "I am nervous" and "I worry that others do not like me." Youth can choose to respond either "Yes" or "No." Children's ratings are summed across items and then a corresponding T-score is determined by age; higher scores indicate higher levels of anxiety. T-scores of 60 or higher on this scale indicate clinically significant levels of anxiety; all other T-scores are considered within normal limits. This scale is reliable and valid across several ethnic groups and was normed on a sample of 6 through 19 year olds. This scale has demonstrated good internal consistency, α = .82 (Reynolds & Richmond, 2008).

Further, due to the nature of self-report measures, the current study utilized the 9-item Defensiveness scale from the RCMAS-2 as a measure of social desirability (i.e., whether

the child is willing to admit to everyday imperfections that are commonly experienced) (Reynolds & Richmond, 2008). This scale includes items such as "I am always good" and "I like everyone I know." A high score (i.e., T-score above 60) on this scale indicates that the individual is not willing to admit to common imperfections or is trying to give an overly positive view of himself (Reynolds & Richmond, 2008).This scale has demonstrated good internal consistency, $\alpha = .79$ (Reynolds & Richmond, 2008).

A large proportion of the child participants (41%, $n = 38$) had high scores on the defensiveness scale of the RCMAS-2 (i.e., T-score higher than 60). As noted in the RCMAS-2 manual, younger children often answer affirmatively on these questions (i.e., they are likely to attempt to present themselves in a positive manner); therefore, their scores were examined carefully to determine bias in responses. Ultimately, their scores were included in analyses because younger children tend to attempt to present a "better" image on direct questions such as those included on the defensiveness scale. While their scores were high on this scale, their overall scores were consistent with norms for this group.

Social Anxiety Scale for Children-Revised (SASC-R; La Greca & Stone, 1993; Appendix E). This widely used scale assessed social anxiety in children. This 22-item scale includes four fillers and 18 items such as "I worry about being teased" and "I worry about what others say about me." Children can respond on a 5-point Likert scale ranging from 1 = *not at all* to 5= *all the time*. Children's scores are summed across the 18 items to obtain a total score, with higher scores indicating higher levels of social anxiety. Total scores of 50 for boys and 54 for girls indicate clinically significant levels of social anxiety. This scale has demonstrated good internal consistencies ranging from .69-.86 (Storch, Barlas, Dent, & Masia, 2002; La Greca & Stone, 1993; Ginsburg, La Greca, &

Silverman, 1998). Also, this scale has demonstrated positive convergent validity with the Social Phobia and Anxiety Inventory for Children, $r = .63$ (Morris & Masia, 1998).

Diet and Physical Activity Questions from the Youth Risk Behavior Survey (YRBS; CDC, 1990; Appendix F). A total of 11 items were used to assess children's diet and physical activity levels, two proposed mediators between children's internalizing symptoms and BMI. The items were taken from the diet and physical activity questions on the Youth Risk Behavior Survey typically utilized by middle school-aged children (CDC, 2007). Seven items concerned dietary intake (healthy and unhealthy eating) and four items concerned physical activity and sedentary behavior during the past week. Sample items include: "During the past 7 days, how many times did you eat fruit?" One item was modified to reflect poor eating habits (i.e., "During the past 7 days, on how many days did you eat *fried or fatty* fast food?"). A sample item regarding sedentary activity included, "On an average school day, how many hours do you watch TV?"

A separate examination of healthy and unhealthy diet, as well as physical activity and sedentary activity, was planned in analyses. Response options for dietary items included, "I did not have any in the past seven days," "1-3 times," "4-6 times," "1 time per day," "2 times per day," "3 times per day," or "4 or more times per day." One item regarding healthy eating had response options that included 0 days through 7 days. Range of possible scores for healthy eating items was 0 – 6 per item for three items and 0-7 for one item. The possible range for total scores was 0 – 25; higher scores indicated healthier diet. Range of possible scores for the three unhealthy eating items was 0 – 6 per item and the possible range for total scores was 0 – 18; items were reverse scored such that higher scores indicated healthier diet.

Response options for the two physical activity items included 0 days through 7 days. The range of possible scores per item was 0-7 and the possible range for total scores was 0-14; higher scores indicated higher levels of physical activity. Response options for the two sedentary activity items included, "None," "Less than 1 hour," "1 hour," "2 hours," "3 hours," "4 hours," "5hours," or "6 or more hours." The range of possible scores per item was 0 – 7 and the possible range of total scores was 0-14; items were reverse-scored such that higher scores indicated less sedentary activity.

The YRBS has been widely used and validated; these subscales also have been used as stand-alone measures of diet and physical activity (Mackey & La Greca, 2007). One reliability study was conducted on a multi-ethnic sample of high school youth, which indicated that students reliably reported health risk behaviors and diet and physical activity behaviors from the YRBS over time (Brener et al., 2002).

Missing Data

While every attempt was made to ensure completion of protocols, approximately 38% (n = 35) of all participants had missing data on at least one of the study variables (e.g., one question from the CDI-SF, RCMAS-2 SF, SASC-R, YRBS, or missing BMI). There were no differences between those participants with missing data and those without regarding age, gender, single parent status, income level, and level of mother's education. Expectation-Maximization (EM) algorithm procedures were used (using the EM option in SPSS version 19) to generate scores for missing data (Schafer 1997; Schafer & Olsen, 1998). Participants who were missing data did not differ from those who were included in any manner; data were missing completely at random (MCAR) or missing at random (MAR), as determined by chi-square analyses reported within EM analyses.

Statistical Analyses

In order to address the specific aims of the study, the following analyses were conducted. Reliability estimates and correlations were conducted on the study variables. Next, demographic control variables were examined in relation to study variables to identify potential control variables. Then, analyses for missingness were conducted to determine a course of action for missing data.

In order to test study hypotheses, several hierarchical sregression analyses were conducted. All internalizing symptoms (i.e., depression, anxiety, and social anxiety) were included in hierarchical analyses. First, to address study aim 1, one hierarchical regression was conducted to determine whether symptoms of depression, anxiety, and social anxiety were concurrently associated with BMI z-scores. Second, to address study aim 2, one hierarchical regression was conducted to determine whether symptoms of depression, anxiety, and social anxiety were prospectively associated with BMI z-scores at Time 2. Third, to address study aim 3, one hierarchical regression was conducted to determine whether internalizing symptoms were associated with change in BMI between time points. Fourth, to address study aim 4, one logistic regression was conducted to determine whether internalizing symptoms were prospectively associated with being overweight or obese. Fifth, to address study aim 5, regressions were planned to determine whether diet and physical activity mediated the above relationships. Sixth, moderation analyses (i.e., hierarchical regressions including interaction terms and subsequent analysis of simple slopes) were conducted to examine the difference between gender groups in the association between internalizing symptoms and BMI at Time 2. Effect sizes and power analyses for each of the regressions are reported below

Chapter 3: RESULTS

Preliminary Analyses

Reliability analyses.

Reliability estimates were calculated for each measure using Cronbach's alpha and are as follows: the CDI-Short Form illustrated good internal consistency, $\alpha = .79$, with all item-total statistics in the expected direction and item-total correlations from .41-.71. The RCMAS-2-SF-TOT demonstrated good internal consistency, $\alpha = .73$, as well as the defensiveness subscale, $\alpha = .61$, and all item-total statistics were in the expected direction and ranged from .40 to .73. The SASC-R demonstrated excellent internal consistency, $\alpha = .91$, and all item-total statistics were in the expected direction, with item-total correlations that ranged from .45 to .77.

Reliability estimates using Cronbach's alpha were also calculated for the child report of the YRBS. Specifically, reliability estimates were calculated separately for healthy and unhealthy eating, and for physical and sedentary activity. Internal consistency for healthy eating items was low, $\alpha = .20$, item-total correlations ranged from .47-.59. Internal consistency for unhealthy eating was high, $\alpha = .60$, with item-total correlations that ranged from .67 to .80. Internal consistency for physical activity was high, $\alpha = .55$, and item-total correlations ranged from .81-.85. Internal consistency for sedentary activity items was also high, $\alpha = .67$, and item-total correlations ranged from .85-.88.

Bivariate correlations and frequencies.

Bivariate correlations. In order to determine the relationships between demographic and primary study variables in this study, bivariate correlations were examined and are displayed in Table 4. Pearson product moment correlations based on one-tailed analyses

were displayed for all correlations. Notably, there were significant correlations between primary study variables; however, these values were not high enough to indicate multicollinearity. Depression and anxiety were moderately correlated, r =.43, p < .001; depression and social anxiety had a moderate correlation as well, r = .49, p < .001; and anxiety and social anxiety were moderately correlated, r = .57, p < .001.

Clinically significant symptoms. At Time 1 data collection, 28% (n = 26; 13 girls) of participants were considered overweight and 19% (n = 18; 6 girls) were considered obese in non-overlapping analyses, so that 47% of the sample was considered overweight or obese. Also, 8.8% (n = 8; 4 girls) of the participants met the cutoff for clinically significant levels of depressive symptoms on the CDI-Short Form (i.e., T-scores greater than 65). Approximately one percent (n = 1 boy) of participants met the cutoff for clinically significant levels of anxiety symptoms on the RCMAS-2-Short Form (i.e., T-scores greater than 70, per the RCMAS-2 manual). Approximately 23.7% (n = 22; 7 girls, 15 boys) of participants met criteria for clinically significant levels of social anxiety symptoms (total score of 50 for boys and 54 for girls).

At Time 2 data collection, 33% (n = 31; 13 girls) of participants were considered overweight and an additional 25% (n = 23; 9 girls) were considered obese.

Regression Analyses

Preliminary statistics. Evaluation of the assumptions of a linear model were examined and revealed no violations of the assumptions. Skewness and kurtosis of the study variables were examined as indicators of normality and all values were in the acceptable range (i.e., no absolute values of skewness > 4 or kurtosis > 10). Further, the normal probability plots of the standardized residuals indicated normality, as they

followed closely to the regression line. The plot of the standardized residuals and standardized predicted values were examined in consideration of the linearity and homoscedasticity assumption. There was no pattern in the data, and thus linearity was upheld. The points on the plot were fairly evenly distributed around the 0 of the *y*-axis, indicating homoscedasticity. There were no influential outliers as indicated by standardized *dfbeta*'s. Thus, the regressions were conducted with no transformations of the data.

Control variables. In terms of coding of variables used in subsequent analyses, parent marital status, parent BMI, total annual income, child ethnicity, immigration status, and school were examined as potential control variables. Only those variables that were significantly associated with child's BMI were utilized as control variables. T-tests were conducted to examine the relationship between child ethnicity (i.e., Hispanic or non-Hispanic) and primary study variables, as well as child immigration status (i.e., born in the US or born outside of the US), but none were significant. Specifically, relationships between ethnicity and: 1) child's BMI at Time 1, t (82) = 1.00, p = .32; 2) child's BMI at Time 2, t(82) = .43, p = .67; 3) CDI T-scores, t(82) = 1.27, p = .21; 4) RCMAS T-scores, t(82) = 1.16, p = .25; and 5) SASCR total scores, t(82) = .35, p = .73, were all nonsignificant. Specifically, relationships between immigration status and: 1) child's BMI at Time 1, t (82) = .92, p = .36; 2) child's BMI at Time 2, t(82) = .26, p = .80; 3) CDI T-scores, t(82) = .72, p = .47; 4) RCMAS T-scores, t(82) = .17, p = .86; and 5) SASCR total scores, t(82) = 1.42, p = .16, were all nonsignificant.

Overall, three variables were utilized as control variables due to their correlation with child's BMI (see Table 5). Specifically, mothers' BMI was used as a continuous variable;

total annual income was categorized into low (0 = under 50K per year) and high (1 = above 50K per year); school was dichotomously categorized (0 = school two and 1 = school one). Child's BMI at Time 1, reported in z-scores, was also utilized as a control variable in prospective analyses.

Study Aim 1. Evaluating concurrent associations between internalizing symptoms and BMI z-scores at Time 1. The concurrent association between depression, anxiety, and social anxiety and children's BMI was first examined using one hierarchical regression analysis (see Table 6). In the analysis, the first step entered demographic variables (including income, school, and mother's BMI) and was significant, $R^2 = .17$; $F\ (3, 89) = 6.23$, $p < .001$. Specifically, higher maternal BMI was associated with a higher child BMI z-score, ß = .26, $p = .02$.

Next, the internalizing symptoms were included in step 2. The shared variance among symptoms of depression, anxiety, and social anxiety accounted for a significant increase in children's BMI, $R^2\Delta = .08$; $F\Delta\ (3, 86) = 3.06$, $p = .03$. However, no internalizing symptoms were uniquely associated with BMI at Time 1, above and beyond the shared variance and the variance accounted for by the control variables. There was a medium effect size, Cohen's $f^2 = .29$, for the final model. Power analyses for the current sample size and number of variables suggest a 99% chance of detecting an increase in R^2 of 5%.

Study Aim 2. Evaluating prospective associations between internalizing symptoms and BMI z-scores at Time 2. The prospective association between depression, anxiety, and social anxiety and youth's BMI was examined using one hierarchical regression analysis (see Table 7). Due to the overlap with Study Aim 6, both analyses were included in one table. In the analysis, the first step entered demographic

variables (including income, school, mother's BMI, gender, and child BMI at Time 1) and was significant, $R^2 = .79$; F (5, 84) = 28.16, $p < .001$. Specifically, child's BMI at Time 1, ß = .74, $p < .001$, was significantly associated with children's BMI at Time 2.

Next, the internalizing symptoms were entered in step 2. However, none of the three internalizing variables were significant predictors of BMI at Time 2 and the step was not significant. Thus, this study hypothesis was not supported; none of the three internalizing measures nor their shared variance were prospectively associated with children's BMI at Time 2. Only child's BMI at Time 1 was significantly associated with child's BMI at Time 2.

Study Aim 3. Evaluating prospective associations between internalizing symptoms and change in BMI z-scores. The prospective association between depression, anxiety, and social anxiety and *change* in youth's BMI z-score was examined using one hierarchical stepwise regression analysis (see Table 8). The first step entered demographic and anthropometric variables (i.e., income, school, mother's BMI, and child BMI at Time 1) was significant, $R^2 = .25$; F (4, 88) = 7.22, $p < .001$. Specifically, child's BMI at Time 1, ß = -.49, $p < .001$, was significantly associated with change in BMI, such that higher child BMI at Time 1was associated with a smaller change in BMI.

Next, the internalizing symptoms were entered in step 2. However, none of the three internalizing variables were significant predictors of change in BMI and the step was not significant.

Thus, this study hypothesis was not supported; none of the three internalizing measures, nor their shared variance, were prospectively associated with a change in

children's BMI. Only child's BMI at Time 1 was significantly associated with change in children's BMI.

Study Aim 4. Evaluating prospective associations between internalizing symptoms and overweight/obese BMI z-score. The prospective association between depression, anxiety, and social anxiety and children's BMI z-score was examined using one hierarchical stepwise regression analysis (see Table 9). The first block entered demographic and anthropometric variables (i.e., income, school, mother's BMI, and child BMI at Time 1). Specifically, per one unit increase in child BMI z-score at Time 1, the odds of being overweight or obese at Time 2 were 36.38 times higher for children who had higher Time 1 BMI z-scores than lower Time 1 BMI z-scores.

Next, the internalizing symptoms were entered in step 2. However, none of the three internalizing variables were significant predictors of being overweight or obese.

Thus, this study hypothesis was not supported; none of the three internalizing measures were prospectively associated with being overweight or obese at Time 2. Only child's BMI at Time 1 was significantly associated with being overweight or obese at Time 2.

Normal to overweight and Overweight to Obese status. Further, there was a small subset of the sample (n = 16) that changed from normal BMI to overweight BMI (i.e., became overweight) or from overweight BMI to obese BMI during the study. The prospective association between depression, anxiety, and social anxiety and odds of moving up in BMI categories was examined using one hierarchical stepwise regression analysis (see Table 10). The first block entered demographic and anthropometric

variables (i.e., income, school, mother's BMI, and child BMI at Time 1) but none were significantly associated with becoming overweight.

Next, the internalizing symptoms were entered in step 2. Anxiety was associated with increasing BMI categories but the step was nonsignificant. Thus, none of the internalizing symptoms were associated with becoming overweight within the full model.

Study Aim 5. Evaluation of mediation effects: The effect of physical activity and diet on the relationship between internalizing symptoms and BMI z-scores at Time 2. Given the nonsignificant results of the above analyses, the mediation model was not conducted. However, relevant analyses are reported below.

Children's physical activity was not associated with BMI at Time 1, r =.07, p = .26, or BMI at Time 2, r = .05, p = .34, but was associated with children's internalizing symptoms (CDI r = -.28, p =.00; RCMAS r = -.32, p = .00; SASCR r = -.06, p = .27). In all cases, greater physical activity was related to lower internalizing symptoms.

Children's sedentary activity was not associated with BMI at Time 1, r = -.16, p = .07, or Time 2, r = -.15, p = .09, or with any of the internalizing symptoms (CDI r = -.04, p = .35; RCMAS r = -.09, p = .21; SASCR r = .04, p = .36).

Children's healthy eating was not associated with BMI at Time 1, r = .06, p = .28, or Time 2, r = .03, p = .38, or with any of the internalizing symptoms (CDI r = .00, p = .48; RCMAS r = .01, p = .45; SASCR r = .14, p = .09).

Children's unhealthy eating was not associated with BMI at Time 1, r = .01, p = .45, or Time 2, r = .03, p = .39, or with any of the internalizing symptoms (CDI r = .01, p = .47; RCMAS r = .00, p = .49; SASCR r = .02, p = .41).

Given the lack of association between diet and physical activity, and BMI at Time 1 or Time 2, along with the non-significant findings from earlier study aims, mediation analyses were not conducted.

Study Aim 6. Evaluation of gender moderation.

Due to previous literature highlighting the differences between boys and girls regarding weight and depression, anxiety, and social anxiety, analyses were conducted to examine potential moderating effects of gender utilizing interaction effects in three separate hierarchical regressions (see Table 7). Specifically, demographic and anthropometric variables were entered in the first step, (including income, mother's BMI, child BMI, and child gender) and the step was significant, $R^2 = .63$; $F\ (5, 84) = 28.16$, $p < .001$.Specifically, child BMI at Time 1, ß = .74, $p < .001$, was significantly associated with BMI z-scores at Time 2, such that higher child BMI at Time 1 was associated with higher child BMI at Time 2.

Next, the second step included centered variables of depression, anxiety, and social anxiety, and was not significant. The third step included the gender interactions with symptoms of depression, anxiety, and social anxiety. Only the interaction between gender and social anxiety was significant, ß = .35, $p = .001$. This indicated that there was an effect of gender on the relationship between social anxiety and BMI at Time 2. Due to this interaction, an examination of simple slopes was examined to determine the nature of the interaction (see Table 11). Per methods utilized by Holmbeck (2002), an examination was conducted separately for males and females. For males, there was no significant association between social anxiety and child's BMI at Time 2, ß = .07, $p = .58$. For females, there was a significant association between social anxiety and child's BMI at

Time 2, ß = .53, p = .00. Specifically, higher social anxiety scores were associated with higher BMI at Time 2 for girls only.

Thus, this study hypothesis was partially supported; there was a gender effect on the interaction between social anxiety and child's BMI at Time 2. For girls only, higher social anxiety at Time 1 was associated with higher BMI at Time 2. Gender moderation analyses were also conducted with the outcomes of change in BMI and change in BMI categories but results were commensurate with those reported in the above sections; there was no gender moderation on the relationship between internalizing symptoms and change in BMI or change in BMI status.

Chapter 4: DISCUSSION

This study was the first attempt to examine whether symptoms of depression, anxiety, and social anxiety were associated with body mass index (BMI) in predominantly Hispanic fourth and fifth grade children. Results of the current study indicated that the shared variance of these internalizing symptoms were associated with children's BMI, such that more internalized distress or negative affect was linked to higher BMI. Further, greater symptoms of social anxiety were prospectively related to higher BMI in girls; this relationship was not observed for boys. Thus, it seems that general negative affect (i.e., shared variance among internalizing symptoms) was a key factor in predicting BMI. Also, gender was a key factor in the prospective relationship between internalizing symptoms and BMI. These findings are discussed in detail in the sections below.

Concurrent association between internalizing symptoms and BMI

The current study was the first to examine whether depression, anxiety, and social anxiety were concurrently linked with higher weight in primarily minority children; findings revealed that the shared variance between depression, anxiety, and social anxiety was associated with BMI. However, no internalizing symptoms were uniquely associated with BMI after accounting for shared variance. Although prior literature illustrated concurrent associations between clinical diagnoses of depression and anxiety and higher BMI in a primarily Caucasian sample of children and adolescents (Rofey et al., 2009), it is possible that it was the shared variance that was driving the findings and making the internalizing variables significant.

Further, it is possible that a more general variable such as negative affect or internalized distress might better account for the association between internalizing

symptoms and BMI. For example, prior literature has illustrated a link between increased negative affect and difficulty with overeating in adults (Jansen et al., 2008). As excess eating is associated with obesity (Collison, Zaidi, Subhani, Al-Rubeaan, & Al-Mohanna, 2010), this is one potential mechanism by which negative affect could be associated with BMI. However, further exploration of the construct of negative affect in relation to BMI in children is needed to better understand the association.

Nonetheless, identification of factors such as internalizing symptoms or even general negative affect that may impact BMI in minority children is very important because prior research has illustrated that minority children tend to have higher rates of obesity (Ogden & Carroll, 2010). Given that a wealth of literature highlighted the association between obesity and several poor health outcomes (Ogden & Carroll, 2010; Grundy, 2000), it is imperative to examine any factors that may impact BMI in minority children. As an important next step, more information is needed about potential underlying processes of the relationship between internalized distress or negative affect and BMI to provide further information about this critical health concern among minority children.

One potential mechanism that may influence the relationship between internalizing symptoms and BMI in children is physical activity. For example, the current study illustrated that symptoms of depression were correlated with BMI; this finding was consistent with prior literature indicating that higher levels of internalized distress, as assessed by symptoms of depression, were associated with lower levels of physical activity in a sample of youth ages 3-18 years old (Sallis, Prochaska, & Taylor, 2000). Further, physical activity has also been associated with lower levels of anxiety in a sample of adolescents and young adults (Strohle et al., 2007). It is also well known that

lower levels of physical activity are associated with higher BMI (Patrick et al., 2004). Therefore, it is possible that depression and anxiety could affect physical activity, and in turn, BMI.

Further, some interventions for anxiety and depression in youth have used behavioral activation, and even exercise, to reduce depressive symptoms (see Larun, Nordheim, Ekeland, Hagen, & Heian, 2009 for a review). Physical activity intervention has also been associated with lower levels of anxiety (Martinsen, Sandvik,& Kolbjørnsrud, 1989). Interventions that target physical activity might be particularly appealing as they could have an additional positive impact on children's weight and health-related behaviors.

Prospective association between internalizing symptoms and BMI

Although the current study examined whether children's internalizing symptoms predicted changes in their BMI over time, this proved to be difficult to evaluate given the strong association between children's BMI across the two time points, and the limited follow-up interval of only six months.

However, findings indicated that gender moderated the prospective association between children's internalizing symptoms and BMI. In fact, findings revealed that the relationship between social anxiety and BMI at Time 2 was significant for girls, but not for boys, in this primarily Hispanic sample. This finding is consistent with research on internalizing symptoms and BMI in primarily Caucasian samples. For example, Anderson and colleagues (2006) found a gender effect among youth ages 9-18 years studied at four time points; anxiety disorders and depression were prospectively associated with a higher BMI z-score in females but not males. However, many of the aforementioned studies examined primarily nonminority samples; the current study extended prior findings by

illustrating a relationship between social anxiety and BMI in a sample of primarily Hispanic girls.

Further, mechanisms underlying this association require additional exploration. Ginsburg and colleagues (1998) reported a link between higher levels of social anxiety and lower levels of social acceptance, self-esteem, and more negative peer interactions. Further, in a study of adults, lower self-esteem was associated with weight gain (Ternouth, Collier, & Moughan, 2009). Thus, it may be informative to explore the link between social anxiety, self-esteem, and weight gain in girls. Overall, given these significant findings associated with social anxiety in girls, it is important to consider inclusion of a screener for social anxiety to potentially identify girls who may be candidates for overweight or obesity intervention.

It is also interesting that internalizing symptoms were not prospectively associated with BMI for boys. This is consistent with prior literature illustrating no significant relationship between internalizing symptoms and obesity for boys (Anderson, Cohen, Naumova, & Must, 2006). Perhaps for boys, externalizing behaviors are more salient in relation to weight; oppositional defiant disorder was associated with chronic obesity in boys and girls (Mustillo et al., 2003). Youth with oppositional behaviors are less likely to follow limits and adhere to boundaries and therefore maybe less likely to adhere to any dietary restrictions or guidelines.

Anxiety and depression. Given that gender moderation was found for social anxiety but not for symptoms of depression or general anxiety, a further exploration of these constructs is warranted. As previously mentioned, it is possible that although relationships between depression and general anxiety and BMI have been found in

samples of primarily Caucasian children (Rofey et al., 2009), those relationships simply do not generalize to primarily Hispanic samples.

Further, as an examination of directionality was not possible within the current study, it is feasible that higher BMI levels affect later levels of internalizing symptoms. Previous studies in adolescents have illustrated a link between BMI and later depression (Pine, Goldstein, Wolk, & Weisman, 2001); therefore it is possible that the reciprocal relationships are important as well. Future studies examining the prospective relationship between obesity and later internalizing symptoms in this age group would address this question. It would also be important to consider general negative affect in reciprocal analyses to determine whether specific internalizing symptoms versus negative affect was associated with BMI.

Other considerations. Further, it is possible that six months was not a long enough time between data collection points to yield enough of a change in BMI to examine some proposed analyses. Many studies of older youth and adolescents that utilized longitudinal data conducted follow up studies at one year or later (e.g., Anderson, Cohen, Naumova, & Must, 2006). Goodman and Whitaker's (2002) study, which obtained significant results with adolescent depression associated with later BMI, had a one year gap between baseline and follow-up. Further, Rofey and colleagues (2009) found that depression and anxiety were associated with increased BMI percentiles in a sample of children and adolescents (8-18 years) who were followed over a three-year time span. Perhaps a longer follow-up period for the current study would have yielded differing results.

Further, it is plausible that other factors not addressed in the current study but previously noted in the literature are more influential in determining later obesity; or perhaps these other factors significantly influence internalizing symptoms examined in this study such that relationships were nonsignificant. For example, neighborhood safety has been associated with overweight and obesity among rural children in fourth to sixth grades (Dupuis, Semchuk, Baxter-Jones, & Rennie, 2011). Further, in a cross-sectional study of children ages five to seven years, smoking in the home and increased birth weight were found to increase the odds of overweight and obesity (Apfelbacher et al., 2008). Therefore, future studies that included an examination of some of these other predictors in relation to internalizing symptoms would be appealing.

Becoming overweight or obese. In the present study, no control variables or internalizing symptoms were associated with children's BMI category increasing to the overweight or obese range. This is not surprising given that only a small number of children became overweight or obese during the six-month study period. Power to detect an effect particularly for this analysis was low because of the sample size.

The findings are in contrast to Goodman and Whitaker's (2002) study, which indicated that depressed adolescents were at increased risk for the *development* and persistence of obesity. However, their sample was primarily Caucasian and was older. It is possible that these relationships do not generalize to younger, primarily Hispanic children. Therefore, further exploration of the role of internalizing symptoms in the development of overweight and obesity in a larger sample of minority youth is warranted.

Role of Physical Activity and Diet

The present study sought to examine whether children's level of physical activity and diet were processes that mediated between internalizing symptoms and their BMI. However, because the potential mediators were not related to BMI, mediation analyses were not conducted. In fact, children's physical activity and diet were also not related to internalizing symptom, with the exception of children's physical activity being associated with fewer symptoms of depression.

It is surprising that physical activity and diet were not associated with BMI. Contradictory to current study results, Patrick and colleagues (2004) found a link between insufficient levels of vigorous physical activity and higher levels of BMI for adolescent boys and girls. Further, it is well known that high caloric intake is associated with higher BMI levels. For example, the energy balance model of adiposity highlights the importance of caloric intake in excess of caloric expenditure in weight gain (Rosenbaum, Leibel, & Hirsch, 1997).

Perhaps in the current study, the modified questions regarding physical activity and dietary intake were insufficient to measure the desired constructs, although similar questions have been used in other studies which did find associations with youths' weight (Dowda, Ainsworth, Addy, Saunders, & Riner, 2001). Further, the reliabilities for diet and physical activity were low, which could indicate that they were not adequate measures of the targeted constructs, at least in this age group. It is possible that consideration of other dietary or activity-related topics would have influenced the analyses. For example, prior research indicated that binge eating specifically was associated with weight gain in children ages 6-12 years (Tanofsky-Kraff et al., 2006).

Perhaps future studies examining diet could include some assessment of binge eating as a more comprehensive measure of dietary intake.

Moreover, it would be important in future studies to assure adequate measurement of dietary intake and physical activity. For example, future studies could include multiple assessments of physical activity and dietary intake. A daily recall or a food and exercise journal that minimizes time between activity and recall (e.g., Baxter et al., 2010) would provide more detailed and accurate information about eating and exercise habits. Alternatively, use of a pedometer could yield accurate results independent of children's recall, and has been found more effective at measuring physical activity than an accelerometer in children ages five to six years (Hands, Parker, & Larkin, 2006). There are also emerging web-based dietary recall systems (e.g., Baranowski et al., 2012) that may yield more accurate results of children's eating habits.

Finally, there could have been potential moderating variables that would have explained the overall lack of relationship between physical activity, diet, and BMI. If overweight children were trying to lose weight, for example, they might have engaged in *more* physical activity and *healthier* dietary habits (i.e., some might not have poorer eating and exercise habits); this might have resulted in an appearance of no relationship between activity, diet, and BMI. Current study methodology made that issue difficult to evaluate. However, future studies could examine this confounding factor by including a question about whether children were attempting to lost weight via modification of diet or physical activity, as well as including a longer longitudinal analysis of diet, physical activity, and BMI.

Other findings. Several important findings emerged from the study analyses regarding the association between demographic factors and children's BMI. For example, maternal BMI was associated with child's BMI. This is consistent with prior literature that highlighted a link between higher parental BMI and higher child BMI (Jiménez-Cruz et al., 2011). Also, child BMI at Time 1 was associated with later child BMI, which is also consistent with research that illustrated the stability of child BMI over time (Hesketh, Wake, Waters, Carlin & Crawford, 2003).

It is interesting that parent marital status and child ethnicity were not significantly associated with internalizing symptoms and BMI. This is in contrast to a prior study that found children of divorced parents had higher BMIs compared with children of married parents (Yannakoulia et al., 2008). However, the current study examined single parent status, not specifically divorced families. Further, the small sample size of the current study could have limited examination of some effects.

Also, previous studies have found associations between minority ethnicity and higher BMI in children (Ogden et al., 2006). The current study did not find differences in BMI between children of the three main ethnic types, but the small sample size did not adequately allow for determination of ethnic differences in BMI. However, it is interesting that the rate of overweight and obesity was so high within the current study sample. Overweight and obesity in the current sample were 47% at Time 1 and 58% at Time 2 compared to approximately 35% within the general population of 6-11 year-old children, and 43% within the Mexican American population in 6-11 year-old children (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Ogden, Carroll, & Flegal, 2008). However, rates of overweight and obesity among children in this age range in public

schools in Miami is approximately 48 % as reported by the Health Connect study (2010). Therefore, current study rates of overweight and obesity were in fact commensurate with rates at other local public elementary schools.

Study Limitations and Future Directions

Although the current study findings are important, certain limitations should be considered. First, the measures of depression, anxiety, and social anxiety are self-report measures and, as with any self-report, are subject to biases. Second, the relatively small sample size may have hindered findings and power to conduct analyses. A larger sample size would allow for testing of more complex models and increased power to detect effects. Third, due to the nature of concurrent analyses, directionality is unclear regarding the association between internalizing symptoms and BMI in children. Fourth, the reciprocal prospective relationships are unclear, i.e., it is unclear whether youth who are overweight are more likely to later exhibit symptoms of depression, anxiety, and social anxiety. Fifth, there are some measurement concerns; specifically, the reliability for the diet and physical activity questions was low and could have impacted their correlations with primary study variables. Sixth, there was limited opportunity to evaluate race/ethnicity as an important variable, as children's race (i.e., Black, White, Asian) was only added to measures for School 1. It would be interesting to examine analyses by race in future studies. Seventh, the time points for assessment were not the same across the two schools. Although school was included as a control variable in the study analyses, having the same time points across schools would have been ideal. Eighth, the six month time frame between the two assessment points made it difficult to assess changes in youths' BMI and weight status due to the stability of children's BMI over time. Despite

these limitations, the results contribute to a better understanding of the relationship between symptoms of depression, anxiety, social anxiety, and children's body mass index.

There are several new directions for research that would increase knowledge in this area. More generally, a replication of this study with a larger and more ethnically varied sample would be important. A more varied sample could provide data for comparisons among various ethnic groups. A longer longitudinal study would also be valuable because it may help to determine how changes in depression, anxiety, and social anxiety are related to changes in youths' BMI over time, and vice versa.

Moreover, it would be interesting to further examine gender in related analyses. There is a gap in the literature regarding factors associated with BMI specifically in boys. A study of potential factors salient for boys is necessary to inform intervention. For example, given that prior research has indicated some connection between externalizing symptoms (e.g., oppositional defiant disorder) and BMI in boys, it would be important to further examine the association between externalizing symptoms and BMI in boys. It would be interesting to determine whether there are any overlapping factors associated with BMI for both boys and girls. An intervention suitable for both genders could potentially impact more children at one time, as opposed to requiring separate interventions by gender.

Also, further study of mechanisms by which these internalizing symptoms impact BMI would be informative. For example, if physical activity and diet were identified as factors that influence the relationship between internalizing symptoms and BMI, an intervention could target not only the internalizing symptoms, but could also include a

nutrition and physical activity component to address multiple aspects of the problem. This could provide more specific targets and a more comprehensive intervention aside from a focus on general internalizing symptoms. A consideration of clinically relevant cut-off points for measures would be interesting, i.e., how many symptoms an individual needs to endorse to be considered at risk for gaining weight. Forexample, it could be determined that, although not clinically significant, a T-score of 55 on the Children's Depression Inventory could be associated with risk of gaining weight.

Despite any limitations and recommendations for future research, this study provided important information regarding depression, anxiety, and social anxiety, and childhood obesity. By identifying specific internalizing disorders prospectively associated with higher body mass index in girls, the present study furthered the field of child obesity research.

Conclusion

Overall, results provided important initial information concerning the relationship between symptoms of depression, anxiety, social anxiety, and body mass index in predominantly minority children. Specifically, this study was the first to illustrate that negative affect or internalized distress (i.e., shared variance among the internalizing symptoms) was concurrently associated with BMI. Further, the current study also illustrated that social anxiety was prospectively associated with higher BMI in girls in a primarily Hispanic sample of children.

It will be important for future researchers to further examine the link between depression, anxiety, social anxiety, general negative affect, and BMI in minority children. Specifically, mechanisms by which internalizing symptoms or negative affect are

associated with body mass index should be examined to identify potential targets of intervention. Clinically, current study findings indicated that negative affect is a potential target for interventions aimed at decreasing weight. Finally, findings highlight the importance of utilization of screeners of social anxiety to assist in identifying girls who may be at risk for becoming overweight.

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Tables

Table 1

Characteristics of Primary Study Variables and Participants (N = 93).

Variables	Overall Mean (SD)	Overall Range	Girls M(SD)	Boys M(SD)
Child Age	9.92 (.68)	9- 11 years	9.79 (.68)	10.04 (.68)
Child BMI 1	.81 (1.17)	-1.54 - 2.94	.67 (1.24)	.93 (1.09)
Child BMI 2	1.06 (1.03)	-1.31 – 2.64	.87 (1.10)	1.23 (.94)
Mother's BMI	26.49 (5.38)	17.16 - 43.89	26.72 (5.46)	26.29 (5.36)
CDI T score	48.16 (9.50)	40.00 – 81.00	49.44 (10.63)	47.06 (8.36)
RCMAS T score	49.33 (8.59)	36.00 – 73.00	49.44 (7.99)	49.24 (9.16)
SASCR total score	42.45 (15.54)	20.00 – 82.00	41.91 (12.96)	42.92 (17.59)
Unhealthy Eating	12.71 (3.73)	0 – 18.00	12.63 (3.74)	12.78 (3.76)
Healthy Eating	12.56 (4.39)	0 – 22.00	12.28 (5.15)	12.80 (3.64)
Physical Activity	6.83 (3.49)	0-14.00	5.77 (3.14)	7.74 (3.54)
Sedentary Activity	7.06 (3.73)	0 – 7.06	7.51 (3.93)	6.68 (3.54)

Note. Child's BMI is reported in z-score values.

Table 2

Characteristics of Primary Study Variables and Participants by Ethnicity (N = 93).

Variables	Hispanic Mean (SD)	Non-Hispanic Mean(SD)
Child Age	9.90 (.671)	10.08 (.64)
Child BMI 1	.76 (1.11)	.42 (1.22)
Child BMI 2	.99 (.99)	.87 (1.06)
Mother's BMI	26.62 (5.47)	24.28 (5.67)
CDI T score	48.30 (8.94)	44.92 (7.76)
RCMAS T score	49.35 (8.21)	46.46 (8.31)
SASCR total score	41.25 (15.40)	39.69 (11.12)
Unhealthy Eating	12.42 (3.83)	14.54 (2.70)
Healthy Eating	12.16 (4.36)	13.69 (4.48)
Physical Activity	6.85 (3.70)	6.54 (2.50)
Sedentary Activity	7.17 (3.77)	7.46 (3.36)

Note. Child's BMI is reported in z-score values. No group differences were significant.

Table 3

Characteristics of Schools Involved in Study.

Ethnicity	School 1	School 1 This Study
Black/Non-Hispanic	76 (22%)	
Hispanic	167 (49%)	12 (48%)
White/Non-Hispanic	99 (29%)	
Non-Hispanic		13 (52%)
Total	342	25

	School 2	School 2 This study
Black/Non-Hispanic	12 (1%)	3 (4%)
Hispanic	1179 (96%)	59 (87%)
White/Non-Hispanic	37 (3%)	6 (9%)
Total	1228	68

Note. The demographic form for School 1 did not include a separate section for race; therefore the only information received was Hispanic vs. Non-Hispanic.

Table 4

Body Mass Index (BMI) changes from Time 1 to Time 2 (N = 93).

BMI change	Details	*N (%)*
Increased	Same BMI category	55 (59%)
	Normal to Overweight	11 (12%)
	Overweight to Obese	6 (6%)
Stayed the same		4 (4%)
Decreased	Same BMI category	14 (15%)
	Overweight to Normal	1 (1%)
	Obese to Overweight	2 (2%)

Table 5

Correlations between Study Variables.

Variables	1	2	3	4	5	6	7	8	9
1.Age	1.00								
2.Income	.05	1.00							
3.School	-.25***	-.63***	1.00						
4.MomBMI	.19*	-.39***	-.35***	1.00					
5.Child BMI 1	.13	-.34***	.23*	.36***	1.00				
6.Child BMI 2	.206	-.34***	.20*	.31***	.91***	1.00			
7.CDI T-score	-.09	-.11	.11	-.06	.25**	.21*	1.00		
8.RCMAS T-score		-.07	-.09	.08	-.10	.19*	.12	.43***	1.00
9. SASCR total	-.11	-.05	.03	-.08	-.23*	.22*	.51***	.58***	

Note. Age is in months; Income =1 (Higher than 50K); Income = 0 (Lower than 50K); Child BMI is in z-scores; School = 0 is School 2; School = 1 is School 1

*p<.05, **p<.01, ***p<.001

Table 6

Study Aim 1: Hierarchical Stepwise Regression Analysis Predicting BMI at Time 1 (N= 93).

	Predictor	Δ R^2	ß step	*B final*	*F*ΔStep
Step 1	Income	.17	-.24	-.20	6.23***
	School		-.00	-.03	
	Mom BMI		.26*	.31**	
Step 2	CDI T-scores	.08		.16	3.06*
	RCMAS T-scores			.06	
	SASCR			.13	

Note. Low Income = 0; High Income = 1; School one = 0; School two =1; CDI= Children's Depression Inventory; SASCR- Social Anxiety Scale, Revised; RCMAS = Revised Children's Manifest Anxiety Scale
F for Final Model: $F(6, 86) = 4.86$, $p<.001$***
*$p < .05$, **$p < .01$, ***$p < .001$

Table 7

Study Aims 2 and 6: Hierarchical Stepwise Regression Analyses

Predicting BMI at Time 2 and Gender Interaction (N=93).

	Predictor	Δ R^2	ß step	*B final*	*F*ΔStep
Step 1	Income	.63	-.17	-.18	28.16***
	School		-.07	-.03	
	Mom BMI		-.03	-.04	
	Child BMIz		.74***	.74***	
	Gender		-.13	-.13	
Step 2	SASCR	.01	.09	-.13	.55
	RCMAS		-.05	-.01	
	CDI		.03	.14	
Step 3	Gender*SASC	.06		.35**	4.75**
	Gender*RCMAS			.03	
	Gender*CDI			-.23	

Note. Low Income = 0; High Income = 1; School one = 0; School two =1; Gender 0 = male; Gender 1 = female; Child BMI is in z-scores; CDI= Children's Depression Inventory; SASCR- Social Anxiety Scale, Revised; RCMAS = Revised Children's Manifest Anxiety Scale.
F for Final Model: $F(11, 78) = 15.80$, $p < .001$***
*$p < .05$, **$p < .01$, ***$p < .001$

Table 8

Study Aim 3: Hierarchical Stepwise Regression Analyses Predicting Change in BMI (N=93)

	Predictor	Δ R^2	ß step	*B final*	*F*ΔStep
Step 1	Income	.25	-.18	-.18	7.22***
	School		-.14	-.12	
	Mom BMI		-.04	-.06	
	Child BMIz		-.49***	-.48***	
Step 2	CDI T-scores	.03		-.05	1.04
	RCMAS T-scores			-.19	
	SASCR			.15	

Note. Low Income = 0; High Income = 1; School one = 0; School two =1; Child BMI is z-scores.
F for Final Model: $F(7,85) = 4.57$, $p < .001$***
***$p < .001$

Table 9

Study Aim 4: Logistic Regression Analyses Predicting Overweight or Obesity (N=93).

	Predictor	OR	95% CI	OR final	95%CI final
Step 1	Income	.13	.01-2.00	.06	.01-4.63
	School	.30	.02-4.04	.19	.01-7.55
	Mom BMI	0.97	.82-1.16	1.07	.87-1.31
	Child BMIz	36.38	6.65-198.92***	30.91	6.20-154.26***
Step 2	CDI T-scores			1.22	.98-1.51
	RCMAS T-scores			.88	.75-1.03
	SASCR			.98	.90-1.08

Note. OR = Odds ratio; CI = Confidence Interval; *p* = p-value; Low Income = 0; High Income = 1; School one = 0; School two =1; Child BMI is in z-scores.
***$p < .001$

Table 10

Results of Logistic Stepwise Regression Analyses Predicting Normal to Overweight and Overweight to Obese (N=16).

	Predictor	OR	95% CI	OR final	95%CI final
Step 1	Income	.21	.02-1.49	.09	.02-1.32
	School	.39	.09-1.80	.38	.08-1.81
	Mom BMI	.95	.84-1.07	.94	.83-1.07
	Child BMIz	1.30	.75-2.27	1.23	.70-2.20
Step 2	CDI T-scores			1.04	.98-1.11
	RCMAS T-scores			.91*	.83-1.00
	SASCR			1.02	.98-1.08

Note. OR = Odds ratio; CI = Confidence Interval; *p* = p-value; Low Income = 0; High Income = 1; School one = 0; School two =1; Child BMI is in z-scores.
*$p < .05$

Table 11

Study Aim 6: Gender Interaction Simple Slopes in Hierarchical Multiple Regression Analyses Predicting BMI at Time 2 (N=93).

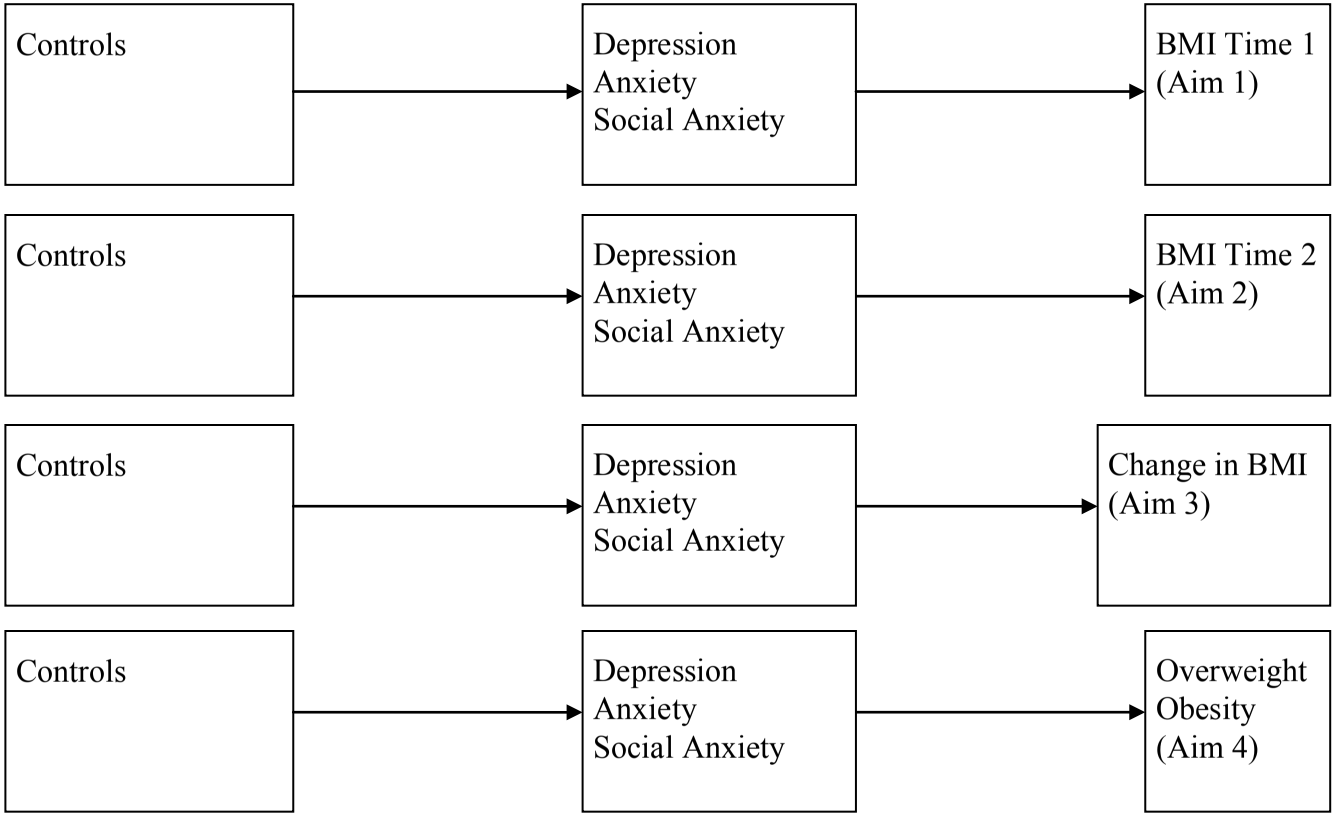
Females					
	Predictor	Δ R^2	ß step	*B final*	*F*ΔStep
Step 1	Income	.16	-.30	-.24	5.49**
	School		-.07	-.02	
	Mom BMI		.22	.25	
Step 2	**SASCR**	.13		**.57****	5.12**
	Females			-.15	
	Females*SASCR			.41*	

Males					
	Predictor	Δ R^2	ß step	*B final*	*F*ΔStep
Step 1	Income	.16	-.30	-.24	5.49**
	School		-.07	-.02	
	Mom BMI		.22	.25	
Step 2	**SASCR**	.13		**.07**	5.12**
	Males			-.15	
	Males*SASCR			.28*	

Note. Low Income = 0; High Income = 1; School one = 0; School two =1; Gender 0 = male; Gender 1 = female; Child BMI is in z-scores; SASCR- Social Anxiety Scale, Revised.
Females *F* for Final Model: F (6, 86) = 5.67, p< .001***
Males *F* for Final Model: F (6,86) = 5.69, p< .001***
*p < .05, **p < .01, ***p < .001

Figure 1.

Study Models for Aims 1-4.



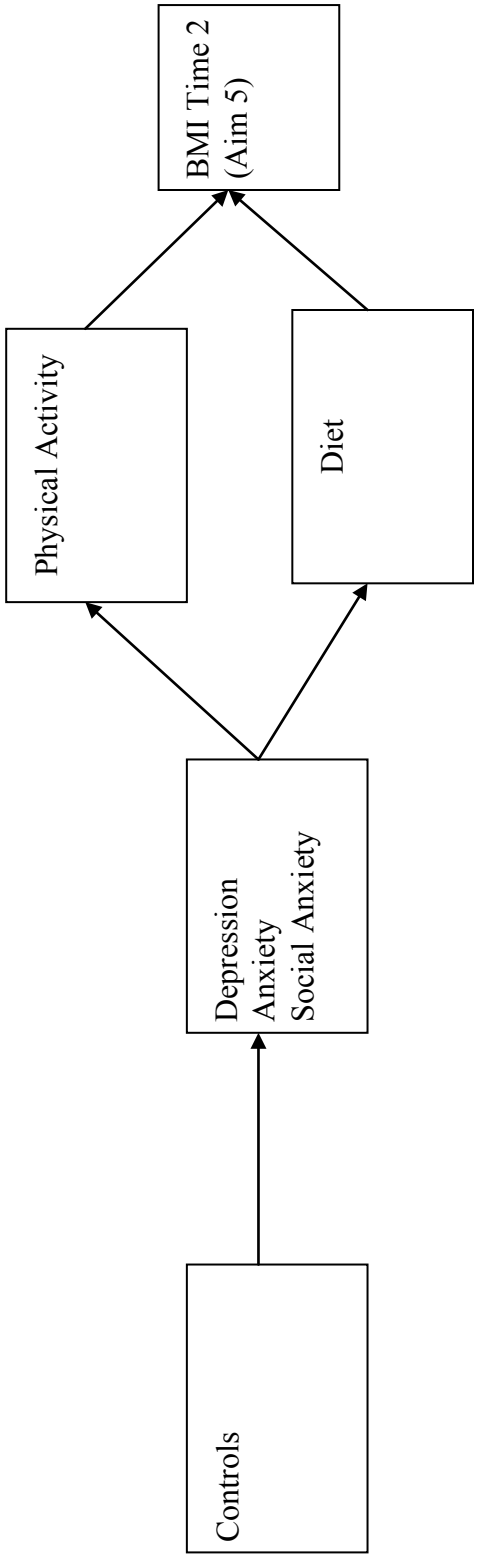


Figure 2.

Study Model for Aim 5.

Figure 3.

Study Model for Aim 6.

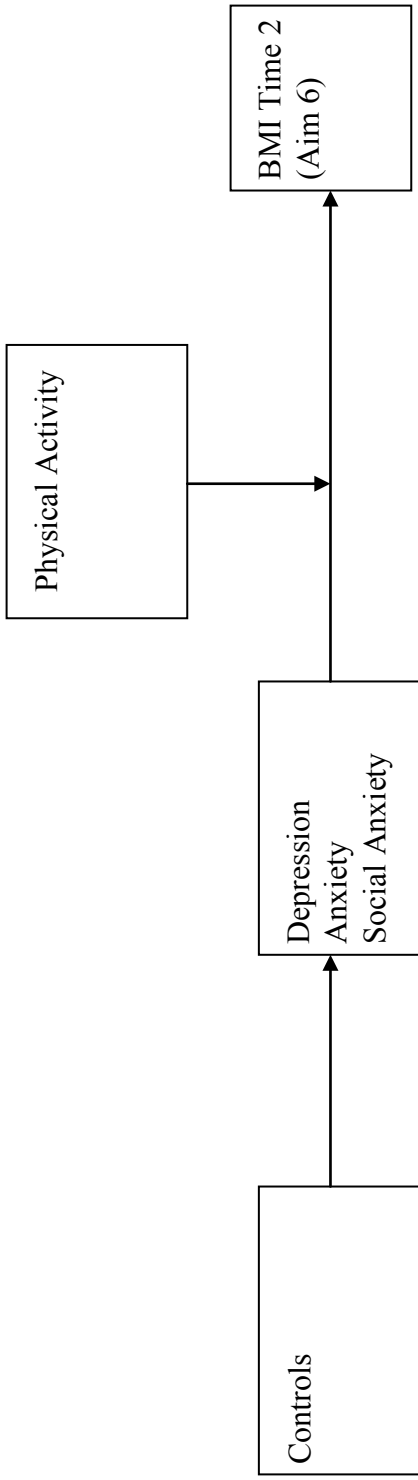
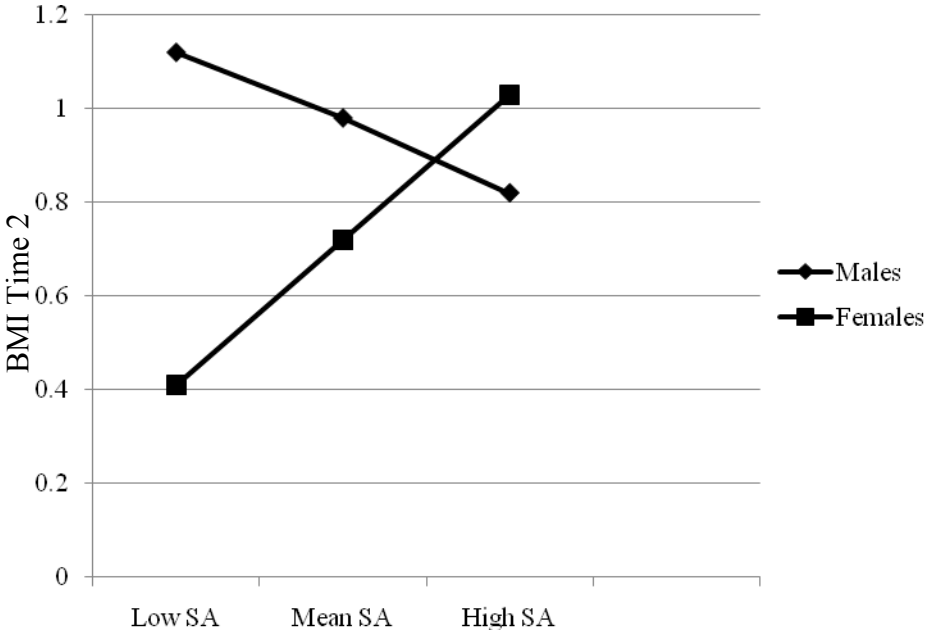


Figure 4.

Gender Interaction of BMI at different levels of Social Anxiety.



Appendix A

Demographic Form

Demographic Information

Child's name: _____ Parent's Name:_____

CHILD information:
Age:_____

Gender (circle one): Male Female

Ethnicity (circle one): Hispanic Non-Hispanic

Where was child born?: _____

When did child move to U.S.?" _____

PARENT information:
Relationship to child (circle one): Parent Other,(please describe _____)

Gender (circle one): Male Female

Highest level of education (circle one):

Less than high school diploma Some high school High school

Some college College degree

Parent occupation: _____

Parent height:_____ Parent weight:_____

Are you married? (circle one): Yes No

Total annual household income range (circle one):

Less than 25,000 per year 25,000-50,000 per year 50,000-75,000 per year

75,000-100,000 per year 100,000-125,000 per year Higher than 125,000 per year

Will you be moving within the next year? (circle one): Yes No

Appendix B

Pubertal Development Scale

(Peterson, Crockett, Richards, & Boxer, 1988)

Pubertal Development Scale

Please read each question and **circle** the answer that is true for you.

1. Development of body hair
    1. has not begun
    2. has barely started
    3. is definitely under way
    4. growth or development is complete

2. My growth spurt
    1. has not begun
    2. has barely started
    3. is definitely under way
    4. growth or development is complete

3. Changes in my skin tone
    1. have not begun
    2. have barely started
    3. are definitely under way
    4. growth or development is complete

GIRLS please complete the next 2 items. **BOYS** skip to question #6.

4. My breast development
    1. has not begun
    2. has barely started
    3. is definitely under way
    4. growth or development is complete

5. My period
    1. has not begun
    2. has begun

BOYS please complete these 2 questions.

6. Changes in my voice
    1. have not begun
    2. have barely started
    3. are definitely under way
    4. growth or development is complete

7. My facial hair growth
    1. has not begun
    2. has barely started
    3. is definitely under way
    4. growth or development is complete

Appendix C

Children's Depression Inventory- Short Form

(Kovacs, 1982)

CDI
Short Form

Directions: Kids sometimes have different feelings and ideas. This form lists the feelings and ideas in groups. From each group of three sentences, pick one sentence that describes you best for the past two weeks. After you pick a sentence from the first group, go on to the next group. The sentences on this form tell how some people think and feel about themselves. Read each sentence carefully, then circle the word that shows your answer and best fits your experiences over the **past two weeks**. There is no right or wrong answer. Just pick the sentence that best describes the way you have been recently. Circle your answer.

1. a. I am sad once in a while.
   b. I am sad many times.
   c. I am sad all the time.

2. a. Nothing ever works out for me.
   b. I am not sure if things will work out for me.
   c. Things will work out for me OK.

3. a. I do most things OK.
   b. I do many things wrong.
   c. I do everything wrong.

4. a. I hate myself.
   b. I do not like myself.
   c. I like myself.

5. a. I feel like crying every day.
   b. I feel like crying many days.
   c. I feel like crying once in a while.

6. a. Things bother me all of the time.
   b. Things bother me many times.
   c. Things bother me once in a while.

7. a. I look OK.
   b. There are some things that are bad about my looks.
   c. I look ugly.

8. a. I do not feel alone.
   b. I feel alone many times.
   c. I feel alone all of the time.

9. a. I have plenty of friends.
   b. I have some friends but I wish I had more.
   c. I do not have many friends.

10. a. Nobody really loves me.
    b. I am not sure if anybody loves me.
    c. I am not sure that somebody loves me.

Appendix D

Revised Children's Manifest Anxiety Scale, Second Edition

(Reynolds & Richmond, 2008)

RCMAS-2
Short Version

Directions: The sentences on this form tell how some people think and feel about themselves. Read each sentence carefully, then circle the word that shows your answer and best fits your experiences over the **past two weeks**.

Circle *Yes* if you think the sentence is *true* about you. Circle *No* if you think it is *not true* about you. Give an answer for every sentence, even if it is hard to choose one that fits you. Do not circle both *Yes* and *No* for the same sentence. If you want to change an answer, draw an **X** through your first answer and then circle your new choice.

There are no right or wrong answers. Only you can tell us how you think and feel about yourself and your experiences over the **past two weeks**. Remember, after you read each sentence, ask yourself, "Is it true about me?" If it is, circle *Yes*. If it is not, circle *No*.

1. Often I feel sick in my stomach.	YES	NO
2. I like everyone I know.	YES	NO
3. I am always kind.	YES	NO
4. I am nervous.	YES	NO
5. I always have good manners.	YES	NO
6. I am always good.	YES	NO
7. I often worry about something bad happening to me.	YES	NO
8. I am always nice to everyone.	YES	NO
9. I fear other kids will laugh at me in class.	YES	NO
10. I have too many headaches.	YES	NO
11. I tell the truth every single time.	YES	NO
12. I worry that others do not like me.	YES	NO
13. I get angry sometimes.	YES	NO
14. I wake up scared sometimes.	YES	NO
15. I sometimes say things I should not say.	YES	NO
16. I get nervous around people.	YES	NO
17. I have told a lie.	YES	NO
18. I feel someone will tell me I do things the wrong way.	YES	NO
19. I fear other people will laugh at me.	YES	NO

Appendix E

Social Anxiety Scale for Children-Revised

(La Greca & Stone, 1993)

SASC-R

This is not a test, there are no right or wrong answers. Please answer each as honestly as you can.

Use these numbers to show HOW MUCH YOU FEEL something is true for you:

1 = Not at all
2 = Hardly ever
3 = Sometimes
4 = Most of the time
5 = All the time

How much does each describe how you feel?

1. I worry about doing something new in front of other kids.....	1	2	3	4	5
2. I like to play with other kids.....	1	2	3	4	5
3. I worry about being teased.....	1	2	3	4	5
4. I feel shy around kids I don't know.....	1	2	3	4	5
5. I only talk to kids that I know really well.....	1	2	3	4	5
6. I feel that other kids talk about me behind my back.....	1	2	3	4	5
7. I like to read.....	1	2	3	4	5
8. I worry about what other kids think of me.....	1	2	3	4	5
9. I'm afraid that others will not like me.....	1	2	3	4	5
10. I get nervous when I talk to kids I don't know very well.....	1	2	3	4	5
11. I like to play sports.....	1	2	3	4	5
12. I worry about what others say about me.....	1	2	3	4	5
13. I get nervous when I meet new kids.....	1	2	3	4	5
14. I worry that other kids don't like me.....	1	2	3	4	5
15. I'm quiet when I'm with a group of kids.....	1	2	3	4	5
16. I like to do things by myself.....	1	2	3	4	5
17. I feel that other kids make fun of me.....	1	2	3	4	5
18. If I get into an argument with another kid, I worry that he or she will not like me.....	1	2	3	4	5

SASC-R, cont'd.

19. I'm afraid to invite other kids to do things with me because they might say no..... 1 2 3 4 5

20. I feel nervous when I'm around certain kids..... 1 2 3 4 5

21. I feel shy even with kids I know well..... 1 2 3 4 5

22. It's hard for me to ask other kids to do things with me..... 1 2 3 4 5

Appendix F

Youth Risk Behavior Survey

(CDC, 2007)

Diet and Physical Activity Questionnaire

The first 6 questions ask about food you ate or drank during the past 7 days. Think about all the meals and snacks you had from the time you got up until you went to bed. Be sure to include food you ate at home, at school, at restaurants, or anywhere else.

1. During the past 7 days, how many times did you eat **fruit**? (Do **not** count fruit juice.)
A. I did not eat fruit during the past 7 days
B. 1 to 3 times during the past 7 days
C. 4 to 6 times during the past 7 days
D. 1 time per day
E. 2 times per day
F. 3 times per day
G. 4 or more times per day

2. During the past 7 days, how many times did you eat **vegetables**? (Like green salad, broccoli, or carrots.)
A. I did not eat vegetables during the past 7 days
B. 1 to 3 times during the past 7 days
C. 4 to 6 times during the past 7 days
D. 1 time per day
E. 2 times per day
F. 3 times per day
G. 4 or more times per day

3. During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, Sprite, or sweetened sports drinks, like Gatorade or Powerade? (Do **not** include diet soda or diet pop.)
A. I did not drink soda or pop during the past 7 days
B. 1 to 3 times during the past 7days
C. 4 to 6 times during the past 7 days
D. 1 time per day
E. 2 times per day
F. 3 times per day
G. 4 or more times per day

4. During the past 7 days, on how many days did you **eat breakfast**?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

5. During the past 7 days, how many times did you eat snacks like candy, chips, cookies, ice cream, or cupcakes?
A. I did not eat those snacks during the past 7 days at school
B. 1 to 3 times during the past 7 days
C. 4 to 6 times during the past 7 days
D. 1 time per day
E. 2 times per day
F. 3 times per day
G. 4 or more times per day

6. During the past 7 days, on how many days did you eat fried or fatty **fast food** (like McDonalds, Burger King, Kentucky Fried Chicken, Wendys, Papa Johns, Dominoes, etc.)?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

The next 6 questions ask about physical activity.
1. During the past 7 days, on how many days were you physically active for a total of **at least 60 minutes per day**?(Add up all the time you spend in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time.)
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

2. On how many of the past 7 days did you exercise or participate in physical activity for **at least 20 minutes that made you sweat and breathe hard**, such as basketball, soccer, running, swimming laps, fast bicycling, fast dancing, or similar activities?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

3. On how many of the past 7 days did you participate in physical activity for **at least 30 minutes** that did **not** make you sweat or breathe hard, such as fast walking, slow bicycling, skating, or pushing a lawn mower?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

4. On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?
A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

5. On an average **week or school day**, how many **hours** of screen time, like watching TV, playing video or computer games or using a computer for something that is not school work, do you get? (Include activities such as Nintendo, Game Boy, PlayStation, Xbox, and the Internet.)
A. I do not get screen time that is not school work on an average school day
B. Less than 1 hour per day
C. 1 hour per day
D. 2 hours per day
E. 3 hours per day
F. 4 hours per day
G. 5 or more hours per day

6. On an average **weekend day**, how many **hours** of screen time, like watching TV, playing video or computer games or using a computer for something that is not school work, do you get? (Include activities such as Nintendo, Game Boy, PlayStation, Xbox, and the Internet.)
A. I do not get screen time that is not school work on an average weekend day
B. Less than 1 hour per day
C. 1 hour per day
D. 2 hours per day
E. 3 hours per day
F. 4 hours per day
G. 5 or more hours per day

Appendix G

Recruitment letter to Parents

SCHOOL LETTERHEAD

Dear Parents:

This school year, _____ Elementary School is participating in a research project on factors that are related to children's weight. The project has been approved by the Office of Program Evaluation for the Miami-Dade Public Schools and by the human subjects review committee for the University of Miami, where we are investigators.

Children's feelings, as well as their diet and physical activity, have been shown to influence their weight. Childhood obesity is an important area of concern, as difficulties with weight in youth have been linked to several poor health problems throughout childhood and as an adult. Therefore, it is important to understand what affects children's feelings, their diet, and their physical activity may have on their weight. Information gained from this study can be used to identify targets for intervention and prevention of children's weight concerns.

Attached is a form that explains the project in greater detail. Before we can begin the project, we need parental consent for children to participate. Please read the attached consent form. If you will allow your child to participate, please sign the form and check the "YES" box; if not, check the "NO" box. Please sign and return the form even if you do not want your son or daughter to participate.

All children will also be asked whether or not they would like to participate. The project will only include children who agree to participate and who have a signed parental consent form.

We appreciate your taking time out of your busy schedule to review the attached materials. Please return the form as soon as possible, preferably no later than **DATE**. A prompt reply will enable us to schedule the project in a timely manner.

Sincerely,

Dr. Alan M. Delamater
Professor of Pediatrics and Psychology, Mailman Center for Child Development
Department of Pediatrics

Cortney J. Taylor, M.S.
Project Director, University of Miami