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Emerging literature has suggested that Attention Deficit/Hyperactivity Disorder (ADHD) may be associated with poorer diet quality, though the processes underlying this link are still unclear. The current study sought to examine how ADHD symptoms are related to diet quality by examining both the direct link between ADHD and diet quality in adolescence, as well as indirect associations through two eating behaviors. External eating, defined as eating in response to external cues, and emotional eating, defined as eating in response to negative affect, were examined as potential mediators of the association between ADHD symptoms and diet quality. Furthermore, this study addressed gaps in the literature by considering how peer problems, a salient environmental context in adolescence, may impact the association between ADHD symptoms and emotional eating. The current study used a path analysis to examine the direct effect of ADHD symptoms at age 15 on diet quality at age 16, as well as the indirect effect through external eating and the indirect effect through emotional eating conditional on peer problems. ADHD symptoms, eating behaviors, and peer problems were measured using questionnaires, while diet quality was assessed through a 24-hour dietary recall. Results revealed a significant direct effect of ADHD symptoms on diet quality, as well as a small but significant indirect effect through external eating, such that higher ADHD symptoms were associated with higher external eating and lower diet quality, as hypothesized. Peer problems significantly moderated the association between ADHD symptoms and emotional eating, such that adolescents with higher ADHD

symptoms and higher peer problems were at greatest risk for emotional eating. Contrary to hypotheses, emotional eating was positively associated with diet quality. Implications for future research and clinical interventions are discussed.

ADHD SYMPTOMS AND DIET QUALITY IN ADOLESCENCE: EXAMINING INDIRECT EFFECTS OF EATING BEHAVIORS AND THE ROLE OF PEER PROBLEMS

by

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CHAPTER I

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a common disorder with onset in childhood that is characterized by developmentally inappropriate levels of inattention, hyperactivity, and impulsivity that often persist through adolescence and adulthood (American Psychiatric Association, 2013). Past research has highlighted many negative outcomes associated with ADHD, including drug use, academic difficulties, and internalizing and externalizing problems (Jensen et al., 2001; Shaw et al., 2012). More recently, researchers have begun to examine negative health outcomes associated with ADHD, and have suggested that there may be a link between ADHD and overweight/obesity (Cortese & Vincenzi, 2011; Nigg, 2013). This area of research has been neglected until recently, as it was previously thought that children and adolescents with ADHD would tend to have lower weight due to increased activity levels associated with the disorder, as well as the side effects of stimulant medications, which can include suppressed appetite. Despite these notions, meta-analytic evidence has revealed an association between ADHD and overweight/obesity (Cortese et al., 2016; Nigg et al., 2016).

Several studies in this area have found a higher than expected prevalence of ADHD in obese patients than in control groups or the general population (Agranat-Meged et al., 2005; Altfas, 2002; Erermis et al., 2004; Fleming et al., 2005). Two meta-

analyses have examined the relation between ADHD and obesity, and results across both meta-analyses showed a significant relation between ADHD and obesity, with the strength of the association growing as age increased (Cortese et al., 2016; Nigg et al., 2016). While this body of research provides evidence for the relation between ADHD and overweight/obesity, the explanation for this association is still uncertain. Clarifying the explanatory mechanisms linking these constructs, particularly in the period of adolescence where this association increases in strength, will help guide future research on this topic.

Several hypotheses have been proposed to explain the link between ADHD and overweight/obesity, outlined by Cortese and Vincenzi (2011). The present study aims to evaluate one of these hypotheses, which proposes that ADHD leads to obesity in part because of poor health-related behaviors related to ADHD symptomology (Cortese et al., 2013; Cortese & Vincenzi, 2011). Diet and activity level constitute the "big two" health behaviors that are considered highly important in predicting weight gain. The present study focuses on one of these health behaviors, examining the relation between ADHD symptomology and diet quality.

The primary goal of the present study is to examine *how* ADHD symptoms relate to diet quality. This was explored by considering two eating behaviors that may be associated with ADHD symptoms, and a potential environmental moderator for one ADHD/eating behavior pathway. As this area of literature is still in its youth, the primary focus thus far has been in examining individual level factors that may influence eating behaviors, while environmental risk factors have largely been neglected. The present

study addresses this gap by considering the role of the peer experience, which constitutes one facet of the environment that is salient in the adolescent period. Furthermore, for adolescents exhibiting ADHD symptoms, peer experiences may be particularly important to examine, since these individuals tend to elicit negative reactions from peers and are at risk for peer rejection and victimization (Diamantopoulou et al., 2005; Hoza, 2007). Recent research has highlighted that lacking or having poor social relationships has been linked to risk for mortality, suggesting that interpersonal relationships not only affect psychological wellbeing, but can also affect physical wellbeing (Holt-Lunstad et al., 2010). Thus, social relationships are an important environmental factor to consider when examining health. While on a larger level, this study aimed to contribute to the understanding of the ADHD/obesity link by elucidating the relation between ADHD and diet quality, the immediate goal of the project was to examine how ADHD symptoms relate to diet quality. This goal was addressed by considering specific eating behaviors expected to be associated with ADHD symptomology as well as the added risk of experiencing interpersonal difficulties with peers.

ADHD Symptoms and Related Deficits

ADHD is a neurodevelopmental disorder described in the Diagnostic and Statistical Manual of Mental Disorders as having two core symptom areas: inattention and hyperactivity/impulsivity (DSM-5, APA, 2013). Inattention is characterized by a range of deficits, including failure to give close attention to details or making careless mistakes, difficulty sustaining attention, seemingly not listening when spoken to, not following through on instructions, difficulty organizing tasks, avoidance of tasks that

require sustained mental effort, losing things necessary for activities, distraction by extraneous stimuli, and daily forgetfulness. Hyperactive/impulsive symptoms include fidgetiness, leaving one's seat when being seated is expected, running or climbing in inappropriate situations, difficulty engaging in leisure quietly, often being "on the go," excessive talking, blurting out answers before the completion of a question, difficulty waiting for one's turn, and interrupting or intruding on others (DSM-5, APA, 2013).

Prior to the publication of the 5th edition of the DSM, these symptom categories mapped onto subtypes of ADHD, which included a hyperactive/impulsive subtype, an inattentive subtype, and a combined subtype. Due to increasing evidence that these subtypes are unstable across time and that symptoms often fluctuate within individuals, the DSM-5 adopted the term "presentation" to replace "subtype" (i.e. "Predominantly Inattentive Presentation" replaced "Inattentive Type"). This change in terminology reflects research showing that an individual may exhibit symptoms from different categories across their lifespan, rather than their symptom profile remaining a stable and trait-like characteristic (Epstein & Loren, 2013; Lahey & Willcutt, 2010). Given this evidence, the current study considered ADHD symptomology overall, rather than categorizing into symptom categories. Furthermore, as the present study draws participants from a community sample, diagnostic criteria will not be utilized and rather the intensity of ADHD symptoms will be examined on a continuous scale.

While the inattentive and hyperactive/impulsive symptom categories make up the diagnostic criteria for ADHD, they do not represent a finite list of the impairments associated with ADHD. For some time, ADHD has been considered a disorder of self-

regulation and was first described as such in Barkley's unifying theory of ADHD (Barkley, 1997). This theory is widely supported in the literature and adds to the understanding of ADHD as given by the clinical diagnostic criteria, which list examples of behavior, but do not represent a deeper understanding of the self-regulatory deficits that give rise to those behaviors (Barkley, 2012). Considering the self-regulatory aspects of ADHD helps to explain other common deficits seen in those who suffer with this disorder that are not present in the diagnostic criteria, but nevertheless impact many individuals with ADHD. ADHD is often seen primarily as a diagnosis that impacts how a child might perform in school, and is not always viewed comprehensively as a disorder involving deficits in self-regulation that impact not just school-related performance and behavior, but behavior across contexts and across the lifespan. Some of these associated self-regulatory deficits include emotion dysregulation, poor effort allocation, impaired time sense, deficient planning abilities, and underdeveloped motor coordination. While these specific deficits will not be measured in the present study, they are mentioned here to highlight the far-reaching implications of ADHD symptoms, and to draw attention to how ADHD symptoms impact various areas of an individual's life, from school performance in childhood to physical health in adolescence.

ADHD Symptoms and Diet Quality

Given increasing evidence showing a link between ADHD and obesity and a need to understand this association, researchers have begun to examine the link between ADHD and diet quality. Diet quality has been shown to be an important factor in predicting obesity, as well as other negative health outcomes such as increased

cardiovascular risk and risk for certain types of cancer (Hu et al., 2016; Nicklas et al., 2012; Potter et al., 2016; Romieu et al., 2017).

Several studies outside of the United States have found a relation between ADHD and diet quality by examining diet content. For instance, Howard and colleagues (2011) examined dietary patterns of a sample of 14-year-old adolescents in Australia and two factors emerged, including "healthy" and "western." These researchers found that ADHD diagnosis was significantly associated with a "Western dietary pattern," which was categorized by higher total fat, saturated fat, refined sugars, and sodium, as well as lower levels of omega-3 fatty acids, fiber, and folate. ADHD diagnosis was not associated with the "healthy" dietary pattern (Howard et al., 2011). Oellingrath, Svedsen, & Hestetun (2014) examined dietary patterns for 12- to 13-year-olds, and found four main diet types, including "varied Norwegian," "junk/convenient," "snacking,", and "dieting." In this sample, there was a significant inverse relation between ADHD symptoms and the "varied Norwegian" diet, which consisted of unrefined plant foods, fish, and water, whereas the relation between ADHD symptoms and the "junk/convenient" diet was significant; this dietary pattern was characterized by processed fast foods, refined grains, and sweets (Oellingrath et al., 2014). In a Korean sample of 7- to 12-year-olds, Woo and colleagues (2014) found four dietary patterns, including "traditional," "traditional-healthy," "seaweed-egg," and "snack," and found an inverse relationship between the "traditional-healthy" diet and ADHD diagnosis. Kim and colleagues (2014) also examined food choices in a Korean sample of children (ages 5 to 13), and found that ADHD symptoms significantly predicted a latent variable of unhealthy eating, which was

composed of soft drink consumption, instant noodle consumption, and westernized fast food consumption (e.g. pizza, hamburgers, deep-fried chicken).

Other studies, rather than statistically categorizing diet types, have examined the frequency of consuming foods in certain food groups. For instance, Ptacek and colleagues (2014) asked parents of 6- to 10-year-old boys in Prague to report on the frequency of fruit/vegetable consumption, as well as frequency of beverage consumption for water and sweetened beverages. According to their parents, boys with ADHD ate fruits/vegetables significantly less frequently than the control group, and boys with ADHD drank more sweetened beverages and less water than boys in the control group (Ptacek et al., 2014). Park and colleagues (2012) took a similar approach in a sample of Korean 8- to 11-year-olds, but measured ADHD symptoms continuously, and found that ADHD symptoms were associated with lower vegetable consumption and higher sweetened dessert consumption. In a German sample of 6- to 17-year-old children, van Egmond-Frohlich, Weghuber, and de Zwaan (2012) also used a continuous approach to measure ADHD symptoms, and found that ADHD symptoms were negatively associated with a measure of diet quality, which assessed the intake of various food groups and scores them based on dietary recommendations. Mian and colleagues (2019) conducted a longitudinal study of ADHD symptoms and diet quality in a Dutch sample utilizing a food frequency questionnaire. This study also examined the temporal direction of the association between ADHD symptoms and diet quality, given that many studies in this area are cross-sectional. Results indicated that ADHD symptoms at age 6 predicted a lower diet quality at age 8, but that diet quality at age 8 did not predict ADHD symptoms at age 10, suggesting that

ADHD symptoms may put children at higher risk of having an unhealthy diet, but not vice versa (Mian et al., 2019).

Few published studies within the United States have examined diet quality for children and adolescents with ADHD, though one study examined diet quality for a group of children and a group of college students with and without a diagnosis of ADHD. No differences in diet quality between individuals with ADHD and without ADHD were found within these groups (Holton et al., 2019). However, these groups had small sample sizes, and results compared differences by group (ADHD vs. non-ADHD), rather than assessing ADHD symptoms on a continuum. Additional research is needed to better understand this association, particularly in the United States.

Though research reviewed above has established a likely association between ADHD and poorer diet quality, mechanisms underlying this association need further exploration. Few studies have examined the potential processes linking ADHD to diet quality, though many have theorized that the deficits associated with ADHD may give rise to specific eating behaviors that contribute to an unhealthy diet. The current study extends the current literature in this area by considering *how* ADHD symptoms may contribute to poor diet quality by examining eating behaviors in the period of adolescence, when individuals are gaining more independence and control over their choices regarding their eating habits.

ADHD Symptoms and Eating Behaviors

Researchers have posited that the individual deficits associated with ADHD can help elucidate why individuals exhibiting symptoms of this disorder may tend toward

poorer quality dietary intake. It is possible that ADHD symptoms are associated with maladaptive eating behaviors. One eating behavior relevant to ADHD and diet quality is external eating, which refers to eating in response to external food cues, such as the sight, smell, or taste of food, rather than in response to internal cues of hunger and satiety (Schachter, 1968; Snoek et al., 2006). An individual high in external eating behavior may decide to eat a tempting food even when they are not hungry, basing their decision to eat on the external appeal of the food or on seeing people around them eating food. External eating has also been associated with increased food craving, which can lead to overeating (Burton et al., 2007). Seeing or thinking about a desirable food may cause individuals high in external eating to seek out food when they are not hungry. External eating is important to consider for diet and weight, as this eating behavior has been linked to overeating, increased unhealthy snack food intake, and increased weight (Burton, Smit, & Lightowler, 2007; Snoek, van Strien, Janssens, & Engels, 2006).

It has been hypothesized that individuals exhibiting ADHD symptoms may be at risk for external eating for several reasons. First, higher levels of impulsivity may make it more difficult to resist eating foods that are externally appealing. Indeed, a few studies have found an association between trait impulsivity and external eating (Elfhag & Morey, 2008; Hou et al., 2011). One study went further by including a laboratory measure of food intake, and found that external eating mediated the relation between trait impulsivity and food consumption in a laboratory eating task (Kakoschke, Kemps, & Tiggemann, 2015). Notably, all of these studies utilized samples of undergraduate students, and thus research with more diverse samples with regard to age and education is still needed.

Furthermore, while laboratory eating tasks are valuable for examining food consumption in a controlled environment, additional studies are needed to understand how these variables influence an individual's food consumption in their daily life. Despite these limitations, these studies highlight the association between impulsivity and external eating.

For individuals exhibiting ADHD symptomology, risk for external eating may in part be due to impulsivity and related difficulties with delay of gratification. Impulsive individuals may not think about what they are eating or why they are eating. Additionally, long-term goals of health may be less accessible to those with ADHD symptoms, who tend towards seeking out shorter, more immediate rewards. Eating healthier but less desirable foods may not provide the instant gratification of desirable but unhealthy foods, since the benefits of healthy eating are not experienced as strongly in the moment. Furthermore, individuals exhibiting ADHD symptomology may also be at risk for external eating due to a lack of attention to internal cues of hunger and reliance on external cues, such as being around other people who are eating, seeing food, or smelling food. Finally, poor attention to or consideration of dietary recommendations may result in individuals with ADHD symptomology choosing foods based on external appeal, rather than considering whether their diet follows nutritional recommendations or what they have already eaten that day. The present study examines whether external eating behavior helps to explain the association between ADHD symptomology and diet quality.

Emotional eating, defined as eating in response to negative affect, is another important behavior to consider when examining eating behaviors for individuals with

ADHD symptoms, given the difficulties with emotion regulation often experienced by those with ADHD (Shaw et al., 2014). The negative affect implicated in emotional eating can include many different emotions, including feeling angry, irritated, bored, discouraged, lonely, disappointed, worried, and frightened (van Strien & Oosterveld, 2008; Wardle et al., 2001). Emotional eating has been linked with poorer diet quality in children and adolescents (Jalo et al., 2019; Nguyen-Michel et al., 2007). Most theories explaining emotional eating operate under a similar framework in which negative emotions trigger eating and eating subsequently results in the relief of negative emotions, reinforcing this behavior (Leehr et al., 2015). This relief may occur due to the comfort or distraction provided by food (Macht, 2008). Specifically, the consumption of food, particularly foods high in fat and sugar, has been shown to increase positive emotions, and has therefore been conceptualized as a way to decrease the experience of negative emotions (Desmet & Schifferstein, 2008; Macht & Dettmer, 2006). This may be due to the pleasurable sensory properties of food, cognitions that food makes people feel good, or due to the activation of neural reward systems (Desmet & Schifferstein, 2008; Gahagan, 2012).

In addition to providing comfort, food may serve as a distraction from negative emotions, as explained by Heatherton and Baumeister's escape theory (1991). Specifically, escape theory conceptualizes eating as a way to escape from an unpleasant emotional state by narrowing one's focus to the present by concentrating on short-term actions and sensations (eating pleasurable foods) rather than engaging in meaningful thought, which may prolong negative feelings (Heatherton & Baumeister, 1991). The

unpleasant emotional state this theory refers to specifically is a state of aversive self-awareness, characterized by negative self-perceptions. By focusing instead on the action of eating, individuals escape the unpleasantness associated with negative thoughts about themselves.

Few studies have examined the relation between ADHD and emotional eating in childhood and adolescence, but some have examined this link in adulthood. In a sample of healthy adult women, Davis and colleagues (2006) found that retrospectively-reported childhood ADHD symptoms were significantly associated with a latent variable that included binge eating, external eating, and two measures of emotional eating. These results were later replicated with a group of adult males, suggesting a significant link for both adult males and females with ADHD symptoms (Strimas et al., 2008). This suggests a potential relation between ADHD symptoms and emotional eating in non-clinical samples of adult males and females. ADHD symptoms and emotional eating was also examined in a sample of obese adults; belonging in the high ADHD symptom group was associated with higher levels of emotional eating (Dempsey et al., 2010).

Two known studies have attempted to assess the association between emotional eating and ADHD for children and adolescents, one in preschool aged children and the other in overweight and obese children between the ages of 8 and 15. Leventakou and colleagues (2015) found that in 4-year-old children in a population-based cohort in Greece, parent-reported ADHD symptoms were associated with parent-reported emotional overeating. In a sample of 8- to 15-year-old overweight and obese German children, Pauli-Pott, Becker, Albayrak, Hebebrand, and Pott (2013) examined relations

between psychopathology symptoms and eating problems. They compared three groups of participants (clinical ADHD, subclinical ADHD, and no ADHD) on a measure of emotional eating, and no significant differences between the groups emerged. Researchers concluded that children with ADHD do not show evidence of eating problems (Pauli-Pott et al., 2013). This interpretation may be somewhat problematic given that in a sample of overweight/obese children and adolescents, it is possible that emotional eating and other eating disturbances are already more elevated than in a sample of average-weight individuals, making further differences between subgroups more difficult to detect. From these few studies, it is difficult to draw definitive conclusions about the relation between ADHD and emotional eating. While there is some preliminary evidence that emotional eating may be elevated in community samples of children and adults with ADHD symptoms, more research needs to be conducted in this area to clarify the strength of this association.

The present study will add to extant literature by examining two eating behaviors theoretically associated with ADHD symptomology, external eating and emotional eating, that may help explain why ADHD is linked to poorer diet quality. While it is expected that these individual behaviors will be important, it is also likely that other factors could contribute this association. An individual's behavior is somewhat influenced by the environmental context, yet existing literature examining dietary behaviors and diet quality for individuals exhibiting ADHD symptomology has largely neglected contextual factors. One salient aspect of a young person's environment that has yet to be examined in this literature is the peer experience. As children grow, their relationships with peers

gain in importance and become more sophisticated. Furthermore, peer experiences may be particularly important to consider when examining roles of the environmental context for young people with ADHD, since a large literature has linked ADHD to peer difficulties, which have been shown to lead to additional negative outcomes for individuals with ADHD over and above those associated with ADHD alone (Mrug et al., 2012). In fact, it is estimated that between 50% and 70% of children with ADHD experience peer difficulties (Gardner & Gerdes, 2015). The current study considers how the role of a negative peer context relates to the association between ADHD symptomology and diet quality with the goal of adding a unique contribution to this literature and providing a more comprehensive picture of this association.

The Role of Negative Peer Experiences

A large body of research has examined overweight/obesity as a risk factor for negative peer experiences, such as peer victimization, lower likability, and fewer friendships; however, the reverse, that is the link between peer problems and later overweight/obesity, has not been examined as thoroughly (Pearce et al., 2002; Zeller et al., 2008). Meta-analytic evidence suggests that social relationships play a vital role in predicting risk for mortality, indicating that relationships with peers appear to have an important influence on health behaviors and health outcomes (Holt-Lunstad et al., 2010). Scant research has examined the role of social relationships in relation to dietary behaviors that might contribute to the risk for obesity, though this has been highlighted as an important area for growth in the field (Salvy & Bowker, 2014).

Two general models have proposed processes to help explain how social relationships may influence health, including the stress-buffering model and the main effects model (Cohen et al., 2001; Holt-Lunstad et al., 2010). The stress-buffering model suggests that social relationships operate as protective in the context of stress by providing informational, emotional, or physical resources to an individual to help them generate adaptive responses to stress. In contrast, the main effects model posits that social relationships directly encourage healthy behaviors, regardless of an individual's experience of stress (Cohen et al., 2001). While it is likely that individuals with ADHD symptoms experience both main and buffering effects of different aspects of social relationships that influence their health behaviors, the present paper approaches this topic from the stress-buffering perspective, whereby having negative experiences with peers constitutes an added risk for those already at risk due to ADHD symptomology.

A substantial body of literature has examined peer experiences for children and adolescents with ADHD, in large part due to the significant struggles that these individuals experience in their peer interactions. Children with ADHD have been found to have fewer friends, friendships of poorer quality, and experience higher levels of peer rejection and victimization than their typically developing peers (Gardner & Gerdes, 2015; Hoza, 2007). These difficulties with peers can be established as early as age 7, and often persist into adolescence (Bagwell et al., 2001; Sibley et al., 2010). Even when individuals with ADHD receive treatment for their symptoms, research has shown that impairment in peer relationships persists even despite a reduction in symptoms (Hoza et al., 2005). This is cause for concern, given that peer difficulties are associated with a host

of negative outcomes, including delinquency, substance use, internalizing and externalizing problems, and mortality risk (Bagwell et al., 1998; Coie & Cillessen, 1993; Holt-Lunstad et al., 2010).

Many behaviors associated with ADHD have been proposed as potentially damaging to social relationships. For instance, individuals with ADHD tend to be impulsive and intrusive in interactions with peers and show lower levels of prosocial behaviors such as sharing and cooperating (Wehmeier et al., 2010). It has also been suggested that those with ADHD tend to exhibit more intense and inappropriate emotional reactions for both positive and negative emotions, which may be off-putting to peers (Gardner & Gerdes, 2015; Thorell et al., 2016). These children and adolescents may also have difficulty with social-problem solving; for instance, those with ADHD tend to struggle with detecting and interpreting social cues and determining cause and effect in social situations (McQuade & Hoza, 2008; Sibley et al., 2010). These social problem solving deficits not only cause risk for peer problems, but also indicate that these individuals may be less able to cope effectively with social stressors if they encounter them (Marton et al., 2009; Sibley et al., 2010).

Because adolescents exhibiting ADHD symptoms are at risk for peer problems, the present study considers how peer problems impact the relation between ADHD symptoms and eating behavior. As negative peer experiences have been associated with many negative emotional outcomes, including loneliness, dysphoria, low self-esteem, and feelings of worthlessness, it is expected that peer problems may impact the relation between ADHD symptoms and emotional eating (Bierman et al., 2015; Pedersen et al.,

2007). These emotional consequences of negative peer experiences could have a detrimental impact on the eating behaviors of adolescents, particularly those with ADHD, who may struggle to regulate these emotions. It is thus expected that peer problems will exacerbate risk for emotional eating for individuals with higher levels of ADHD symptoms, as added negative affect associated with peer problems could lead adolescents to cope by turning to increased intake of unhealthy foods, particularly considering that they may already have difficulty coping with negative emotions.

Furthermore, drawing from the stress-buffering model of social relationships and health, it is possible that adolescents experiencing peer problems lack an emotional resource (i.e. peer support) needed to promote an adaptive response in the context of their ADHD-related deficits. Adolescents with positive peer relationships may rely on friends as a coping resource when experiencing negative emotions. Conversely, adolescents with peer problems may lack peer support and turn to coping resources that are more accessible to them, such as the consumption of food through emotional eating. Individuals with ADHD symptoms may be in greater need of coping resources, given their propensity for emotion dysregulation as well as deficits in social problem solving, and thus lacking these resources may be particularly detrimental for these adolescents.

Given this evidence, the present study examined whether the experience of peer problems exacerbates the relation between ADHD symptoms and emotional eating. It was expected that experiencing peer problems would cause increases in negative emotions with which adolescents with ADHD symptoms have to cope, as well as an absence of peers as a coping resource. While other individuals in an adolescent's life may

serve as coping resources, peers are expected to have particular importance due to the developmental context of adolescence. As children move into adolescence, they begin relying more on peers than parents for companionship and begin to spend more time socializing with peers than with parents (Buhrmester et al., 1992; Hartup, 1989). It was thus expected that lacking peer support specifically would be detrimental at this developmental stage.

In sum, while literature has linked ADHD diagnosis and symptomology with increased dietary intake of poorer nutritional quality, little research has examined the explanation for this link. While researchers have hypothesized that the symptoms of ADHD directly contribute to unhealthy eating behaviors, this has not been empirically tested. The present study considered two eating behaviors that may be associated with ADHD symptoms, including external eating and emotional eating, which may help explain the link between ADHD symptoms and diet quality. Furthermore, the current study also considers the context of peer problems in explaining this association, examining how peer problems impact the link between ADHD symptoms and emotional eating, as peer problems may exacerbate negative emotionality and lack of peer emotional support may be detrimental to effective coping. As few studies have examined *how* ADHD symptomology is associated with increased energy intake, the present study aims to clarify this link. Considering that diet quality is a significant contributor to obesity, a common and harmful health condition recently found to be associated with ADHD, studies aimed at clarifying how risk factors such as ADHD symptomology impact this outcome are necessary.

Study Goals and Hypotheses

The aim of the current study is to understand the relation between ADHD symptoms and diet quality in adolescence. Specifically, this study aimed to test the indirect effects of ADHD symptomology on diet quality through two eating behaviors. External eating will be considered as one eating behavior expected to explain the link between ADHD symptomology and dietary outcomes. This eating behavior is characterized by eating due to external appeal of food or due to external cues for eating, such as being around other people who are eating. External eating is expected to be associated with ADHD symptomology due to difficulty resisting externally appealing foods based on their smell, appearance, or taste, as well as poor attention to internal cues of hunger and lack of adherence to nutritional guidelines or long-term goals of health in the face of more immediate rewarding sensations.

Emotional eating, defined as eating in response to negative affect, will be considered as another explanatory variable in the ADHD/diet quality relation. Individuals with ADHD symptoms have been shown to have difficulty regulating negative affect and thus may be at increased risk to cope with negative emotions by eating, whether as a means of increasing positive emotions or escaping negative self-perceptions.

The current study also adds a novel piece to this area of literature by examining the context of negative peer experiences, as individuals exhibiting ADHD symptoms often struggle in the peer domain. This study considered whether experiencing difficulties with peers puts an adolescent with ADHD symptoms at even greater risk for emotional eating. Adolescents experiencing peer problems may turn to food to cope with negative

emotions associated with these problems, or may use food to cope due to lacking the emotional coping resources they might otherwise receive from peers.

Study Aim: Evaluate the direct and indirect influence of ADHD symptoms on diet quality through external eating and an interaction between emotional eating and peer problems.

1. Higher ADHD symptoms will predict lower diet quality

2. Higher ADHD symptoms will predict greater external eating behavior, which will in turn be associated with lower diet quality.

3. The link between ADHD symptoms and emotional eating will be moderated by peer problems such that adolescents with higher ADHD symptoms and more peer problems will be at the greatest risk for higher emotional eating when compared to individuals with lower ADHD symptoms and/or fewer peer problems. Higher emotional eating will in turn be associated with lower diet quality.

CHAPTER II

METHODS

Recruitment and Attrition

The current study utilized data from three cohorts of children who are part of an ongoing longitudinal study of social and emotional development. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems, and who were representative of the surrounding community in terms of race and socioeconomic status (SES). All cohorts were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants for cohorts 1 and 2 were recruited at 2-years of age (cohort 1: 1994-1996 and cohort 2: 2000-2001) and screened using the Child Behavior Checklist (CBCL 2-3; Achenbach, 1992), completed by the mother, in order to over-sample for externalizing behavior problems. Children were identified as being at risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of males and females. This recruitment effort resulted in a total of 307 children. Cohort 3 was initially recruited when infants were 6 months of age (in 1998) for their level of frustration, based on laboratory observation and parent report, and were followed through the toddler period (see Calkins, Dedmon, Gill, Lomax, & Johnson, 2002, for

more information). Children from Cohort 3 whose mothers completed the CBCL at two-years of age ($N = 140$) were then included in the larger study. Of the entire sample ($N = 447$), 37% of children were identified as being at risk for future externalizing problems. There were no significant demographic differences between cohorts with regard to gender, $\chi^2(2, N = 447) = .63$, p = .73, race, $\chi^2(2, N = 447) = 1.13$, p = .57, or two-year SES, $F(2, 444) = .53$, $p = .59$.

Of the 447 originally selected participants, six were dropped because they did not participate in any data collection at 2 years old. An additional 12 families participated at recruitment, did not participate at two-year, but did participate at later years. At age 15, 327 families participated, including 27 families that did not participate in the 10-year assessment. There were no significant differences between families who did and did not participate in the 15-year assessment in terms of race $\chi^2(3, N = 447) = 3.96$, $p = .27$; 2-year SES $t(432) = -.56$, $p = .58$; or 2-year externalizing T score $t(445) = .24$, $p = .81$. Boys were less likely to participate in the 15-year assessment $\chi^2(1, N = 447) = 9.31$, p = .002. At the 16-year assessment, data were collected beginning in Spring of 2014. Participants reported on health behaviors through online questionnaires. At the 16-year assessment, 196 participants completed questionnaires and 166 participants completed dietary recalls. The Institutional Review Board at the University of North Carolina at Greensboro reviewed and approved study procedures.

Participants

Participants will include adolescents who attended laboratory assessments as part of the RIGHT Track Project at age 15 and the RIGHT Track Health Project at age 16.

Only participants who completed dietary recalls at age 16 were included, resulting in a sample size of 166.

Procedures

Each adolescent and one parent, typically the adolescent's mother, participated in laboratory assessments. Assessments were conducted at the University of North Carolina-Greensboro psychology department at age 15, and at the University of North Carolina-Greensboro kinesiology department at age 16. For participants who were not able to come into the laboratory, questionnaire data were completed. At age 16, participants completed three phone interviews to assess 24-hour nutritional recalls. Consent and assent were collected by the experimenters at each visit prior to the start of any data collection. Questionnaires were completed by the participant and mother at ages 15 and 16 to assess demographics, behaviors, and other variables of interest. Data from mother and adolescent questionnaires, as well as adolescent dietary recall, were utilized in the current study.

Measures

ADHD Symptoms. The current study assessed ADHD symptoms at age 15 using the ADHD Rating Scale-IV, which was completed by the parent and the adolescent (DuPaul et al., 1998). The total ADHD scale was utilized from each reporter and is composed of 18 items describing the symptoms of ADHD. The rate of occurrence of each of these symptoms is rated on a 4-point Likert scale ranging from 0 ("never or rarely") to 3 ("very often"). The current study utilized a mean score to represent the frequency of

ADHD symptoms exhibited by participants, according to their self-report and parent's report. The scale demonstrated good internal consistency (α=.94).

External Eating. External eating was assessed at age 16 using the Three Factor Eating Questionnaire (TFEQ) (Stunkard & Messick, 1985). The current study utilized a 6-item subscale of the TFEQ, known as the External Locus for Hunger scale, as described in a factor analysis by Bond, McDowell, and Wilkinson (2001). In the present sample, the scale showed moderate internal consistency and the value was comparable to that found in the abovementioned factor analysis (α=.61). Reliability analysis indicated that the removal of any one item from the scale would not improve the internal consistency; therefore, all items were retained. This scale assesses whether participants report that their hunger is triggered by external cues (e.g. "when I see something really delicious or yummy," "being with someone who is eating."). For most items, participants are asked to mark items as "true" or "false." Two items on this scale are rated on a 4-point likert scale, though are recoded as dichotomous (0 and 1 = 0; 2 and 3=1).

Emotional Eating. Emotional eating was assessed at age 16 using the Three Factor Eating Questionnaire (TFEQ) (Stunkard & Messick, 1985). The current study utilized a 3-item subscale of the TFEQ, known as the Emotional Susceptibility scale, as described in a factor analysis by Bond, McDowell, and Wilkinson (2001). The scale showed good internal consistency and was comparable to the reliability statistics in the abovementioned factor analysis (α=.80). This scale assesses whether participants report eating in response to negative affective states (e.g. "When I feel sad or down, I often

overeat," "When I feel anxious, I find myself eating."). Participants were asked to mark items as "true" or "false."

Peer Problems. Peer problems are conceptualized in this study as an adolescent's general experience of negativity in their peer interactions. This may involve being disliked, rejected, victimized, or ignored by peers. This construct was assessed using the Social Stress subscale on the self-report form of the Behavior Assessment System for Children – Second Edition (BASC-2 SRP), which was collected when adolescents were 15 years old. This scale assesses the adolescent's perception of stress in relation to their peer interactions and captures feelings of loneliness and tension, as well as a lack of social coping resources (e.g. "I am lonely," "People say bad things to me," "I am left out of things") (Reynolds & Kamphaus, 2004). Internal consistency in the present study was good (α=.75).

Diet Quality. Diet Quality was assessed using the Healthy Eating Index (HEI) 2015 score. When participants were 16 years old, 24-hr dietary recalls were collected and assessed by the Nutrition Obesity Research Center (NORC) at the University of North Carolina-Chapel Hill. The majority of participants completed three recalls (n=151), though some completed two (n=7) or one (n=8). HEI scores did not vary based on the number of recalls completed. Data were analyzed using the Nutrition Data System for Research (NDSR) software developed by the University of Minnesota Nutrition Coordination Center. Trained interviewers conducted phone calls with participants on two weekdays and one weekend day and obtained a list of all foods and beverages consumed in the past 24 hours. Details about amounts consumed and method of food

preparation were also gathered. Data from the recalls were averaged across days to determine the diet quality using the total HEI-2015 score. The HEI assesses diet quality with regard to the 2015 Dietary Guidelines for Americans and includes 13 components, including total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, saturated fats, and added sugars. The overall HEI score is a sum of each component score. Scores are calculated from the nutrient and food group outputs as described by Wiltheiss et al (2013).

CHAPTER III

RESULTS

Data Analytic Plan

Preliminary analyses were conducted using SPSS version 23. Missing data were handled first using single imputation at the item level for questionnaire measures by using the expectation maximization (EM) method. This accounted for missing items on questionnaires (for instance, if an item or items on a questionnaire were skipped). Full information maximum likelihood (FIML) was used to account for missing data on questionnaire measures. Dietary recall data was not estimated and thus only participants who completed dietary recalls were included in the present study. Preliminary analyses were run to examine descriptive statistics on all study variables and to assess normality of data.

Main analyses were completed in Mplus 8 (Muthén & Muthén, 2017). The moderated mediational path model was analyzed according to procedures described by Hayes (2013). Bias-corrected bootstrapping procedures (10,000 draws) were utilized to test the direct and indirect effects. Bias-corrected bootstrapping procedures have been determined an effective method to examine conditional and unconditional indirect effects without assuming data are normally distributed, and are effective in reducing Type 1 error (Williams & MacKinnon, 2008). Confidence intervals were generated by the

bootstrapping procedure to evaluate the significance of the indirect effects. Model fit was evaluated by considering various indices, including a non-significant chi-square test, an RMSEA less than .08, an sRMSR value less than .10, and a CFI greater than .90 (Kline, 2005). A significant interaction effect was observed and evaluated using the Johnson-Neyman regions of significance technique, which calculates the range of values of the moderator for which the effect of the predictor on the outcome is significantly different from zero (Johnson & Neyman, 1936; Preacher et al., 2006). In the present study, this technique will calculate the values of peer problems at which ADHD symptoms significantly predict emotional eating.

Preliminary Analyses

Tables 1 and 2 provide descriptive statistics for all study variables. Skew and kurtosis were within normal limits for all variables, and thus no transformations were necessary. Study variables were then examined as they relate to demographic variables (sex, race, SES) and a potential covariate (BMI). Given group sizes as described in Table 1, race was collapsed into White and non-White groups and considered as a dichotomous variable. T-tests were conducted to assess for potential differences by sex and race across all study variables. No significant differences were found for any study variables based on sex, and thus sex was not included in the model as a control variable. Significant differences based on race were seen for BMI, SES, and diet quality. These results showed that non-White participants had higher BMI (M=22.85, SD=4.38; M=25.34, SD=4.94), lower SES (M=47.72, SD=12.23; M=40.40, SD=13.70), and lower diet quality (M=49.64, SD=11.64; M=45.90 SD=9.80) than White participants (t(123)=-2.81, p=.006;

t(145)=3.22, p=.002; t(164)=2.08, p=.04). Given the association between race and diet quality, race was included as a covariate in predicting diet quality. Although BMI and SES were associated with race, these variables were not significantly associated with any dependent variables and were thus not included as covariates in the model. The model with race as a covariate can be found in Figure 2.

Correlations between all variables were also examined and can be found in Table 3. A significant correlation was observed between SES and ADHD symptoms, indicating that higher SES was associated with lower ADHD symptoms. This is consistent with literature showing an association between ADHD and family socioeconomic disadvantage (Russell et al., 2014). SES was also significantly negatively associated with BMI, a finding consistent with prior research (Delva et al., 2006). However, SES was not significantly associated with diet quality in the present study, which is inconsistent with some studies in the literature (e.g. Darmon & Drewnowski, 2008). As expected, ADHD symptoms were positively and moderately associated with peer problems, emotional eating, and external eating, and negatively moderately associated with diet quality. Additionally, emotional eating and external eating were strongly correlated, consistent with prior literature and with these scales coming from the same measure (Snoek et al., 2007). Neither emotional eating nor external eating showed significant correlations with diet quality. Peer problems were positively associated with emotional eating, as expected.

Main Analyses

The model demonstrated adequate fit (χ^2 (9) = 15.97, p = 0.07; RMSEA = 0.07; CFI = 0.92; SRMR = 0.05). Standardized parameter estimates for the model can be found in Figure 3.

Direct Effects. As hypothesized, ADHD symptoms at age 15 were significantly and negatively associated with diet quality at age 16 (β = -0.29, S.E. = 0.07, p < 0.001), indicating that ADHD symptoms are associated with poorer diet quality. ADHD symptoms also significantly predicted external eating (β = 0.27, S.E. = 0.09, p = 0.002). ADHD symptoms did not significantly predict emotional eating (β = 0.13, S.E. = 0.10, p = 0.20). Peer problems also had no effect on emotional eating (β = 0.13, S.E. = 0.09, p = 0.14). These results indicate that higher ADHD symptoms were significantly associated with higher external eating, but not emotional eating. Contrary to hypotheses, when controlling for race and emotional eating, there was no direct association between external eating and diet quality, though this effect approached significance (β = -0.14, S.E. = 0.08, p = 0.08). Emotional eating was marginally associated with diet quality in the opposite direction than hypothesized (β = 0.19, S.E. = 0.10, p = 0.047), suggesting that when controlling for the effects of race and external eating, higher emotional eating was marginally associated with higher diet quality.

Moderating Effects. Consistent with hypotheses, peer problems moderated the association between ADHD symptoms and emotional eating (β = 0.18, S.E. = 0.08, p = 0.03). This suggests that the effect of ADHD symptoms on emotional eating is conditional on peer problems. The Johnson-Neyman technique was utilized to calculate

regions of significance for this moderation effect, determining the values of peer problems for which the effect of ADHD symptoms on emotional eating is significant. Results revealed that when peer problems were approximately one half of a standard deviation above the mean and higher, higher levels of ADHD symptoms were associated with higher levels of emotional eating. These results are illustrated in Figure 4. As the graph shows, the 95% confidence bands no longer include 0 when the value for peer problems is about 2 or higher (M=0, SD=4.81). This suggests that adolescents with higher levels of ADHD symptoms were at greater risk for emotional eating if they experienced higher levels of peer problems (approximately .42 SD above the mean and higher), but not at mean and low levels of peer problems.

Indirect Effects. Indirect effects were examined to determine whether ADHD symptoms have an effect on diet quality through external eating, as well as a conditional indirect effect through the interaction of emotional eating and peer problems. Results of these analyses, which include unstandardized parameter estimates of the indirect effects and 95% bias-corrected bootstrapped confidence intervals, can be found in Table 4. ADHD symptoms were negatively associated with diet quality through external eating (B = -0.98, 95% CI [-2.88, -0.01]), suggesting that higher ADHD symptoms were associated with lower diet quality through the increased risk for external eating behavior. A conditional indirect effect was observed, such that the interaction of ADHD symptoms and peer problems predicted diet quality through emotional eating. Results indicated that at high levels of peer problems, ADHD symptoms significantly predicted diet quality through emotional eating (B = 1.44, 95% CI [0.07, 4.56]. This suggests that for

adolescents experiencing high levels of peer problems, higher ADHD symptoms were positively associated with diet quality through higher emotional eating. While it was expected that higher levels of peer problems would put adolescents with higher levels of ADHD symptoms at greater risk for emotional eating, it was not expected that emotional eating would be positively associated with diet quality, and this indirect effect is thus not consistent with hypotheses. Notably, these indirect effects are very small. Even when controlling for the indirect effects, a significant direct effect of ADHD on diet quality remained in the present study (B = -7.80, 95% CI [-12.36, -3.48].

Posthoc Analyses

Emotional eating and other eating behaviors

Emotional eating produced unexpected results in the present study, showing a positive association with diet quality such that higher emotional eating was associated with better diet quality. It is possible that in the present study, emotional eating may be associated with a pattern of eating involving both binge-eating and restrained eating. Given that participants' diet quality was assessed on 1-3 days of dietary recall, it is conceivable that if participants have inconsistent eating patterns day to day due to dietary patterns characterized by binging and restraining eating, their diet quality may not be accurately estimated when completing a dietary recall.

To examine this hypothesis, associations between emotional eating, restrained eating, and binge eating should be examined. Although the present study does not include a measure of binge eating, two items on the Three Factor Eating Questionnaire (TFEQ) were examined in posthoc analyses in an attempt to approximate this construct. These

items ask participants to answer the following statements using a 4-point Likert scale: "Do you go on eating binges though you are not hungry?" and "Do you control or restrain your eating while in front of others and splurge later on when you are alone?" Higher scores on these items indicate a higher rated frequency of the behavior by the adolescent. While these are solely individual items and are not validated measures of binge eating, relations between the emotional eating scale and these items may help clarify other eating behaviors associated with emotional eating and inform future research hypotheses.

The association between emotional eating and dietary restraint, using the cognitive restraint subscale on the TFEQ, were also examined. Dietary restraint refers to deliberately eating less than one would like, and was examined in posthoc analyses to explore whether emotional eating may be associated with inconsistent eating patterns involving binging and restraining food intake. This correlations matrix can be found in Table 5. Correlations between these variables indicate that emotional eating is significantly associated with both binge-eating-related items as well as with the scale for cognitive restraint. Specifically, emotional eating was positively associated with going on "eating binges though you are not hungry" ($r = 0.30$, $p < .001$), "control or restrain your eating while in front of others and splurge later on when you are alone" ($r = 0.27$, $p = .001$), and restraint ($r = 0.20$, $p = .014$). Considering these associations, it appears likely that individuals reporting higher levels of emotional eating may have an inconsistent eating pattern that includes both binge eating and restrained eating. As seen in the correlations matrix in Table 5, dietary restraint is associated with higher diet quality in this sample. Although dietary restraint has traditionally been considered a risk factor for

eating pathology, more recent research shows evidence for both healthy and unhealthy implications of dietary restraint (Schaumberg et al., 2016). A full discussion of dietary restraint goes beyond the scope of the present study, but restraint may be important in understanding the eating behavior of those reporting higher emotional eating. In the present study, it is possible that dietary recalls were completed on days that participants high in emotional eating behavior were also restraining their eating, resulting in a diet quality that appears more healthy and that may not accurately reflect long-term behavior.

Inattention and Hyperactivity

The current study examined ADHD symptoms of inattention and hyperactivity as a singular construct, as these symptom categories are not seen to be stable and separate across time. However, given that the present study utilized a community sample with few individuals meeting clinical criteria for ADHD, it was conceivable that these symptom categories could be operating differently than in clinical samples of individuals diagnosed with ADHD. Given this possibility, inattentive and hyperactive/impulsive symptoms were examined separately in posthoc analyses.

Entering both hyperactivity/impulsivity and inattention in the model simultaneously was considered; however, the correlation of inattentive and hyperactive/impulsive symptoms was high ($r = 0.75$, $p < .001$). Separate models were run with inattentive symptoms only and hyperactive/impulsive symptoms only. These models showed similar patterns of results, which was unsurprising given the high correlation. This suggests that in the present sample, hyperactive/impulsive symptoms and inattentive symptoms are best considered together as one construct capturing ADHD symptoms.

CHAPTER IV

DISCUSSION

Research in recent years has illuminated negative health-related outcomes associated with ADHD, including overweight and obesity, which may increase risk for mortality. One factor that contributes to weight is an individual's diet quality, and research has suggested that individuals with ADHD may consume diets of poorer quality. The present study sought to better understand this risk pathway by examining eating behaviors and a contextual peer factor that may help explain why individuals with ADHD symptoms have poorer diet quality. This study was unique in examining ADHD symptoms and diet quality across a period of one year, and by using a 24-hour dietary recall procedure, considered a high quality measurement of diet quality. Given the serious health risks associated with poor diet quality, including risk for obesity, cardiovascular problems, and mortality, it is crucial to better understand whether and why individuals with ADHD may be at risk for poorer diet quality so that appropriate and timely interventions can be implemented (Kaluza et al., 2009; Kant et al., 2000; Nicklas et al., 2012).

ADHD Symptoms and Diet Quality

The present study showed that ADHD symptoms at age 15 significantly predicted diet quality at age 16, such that teens with higher self- and mother-reported ADHD symptoms at age 15 had significantly lower scores on the Healthy Eating Index at age 16.

This finding replicates past research that has found a link between ADHD and diet quality (Mian et al., 2019; van Egmond-Fröhlich et al., 2012). Furthermore, this study shows that this relation is predictive across a period of one year, and utilized a dietary recall procedure to calculate diet quality, considered a high quality measurement approach for diet quality. In posthoc analyses, results indicated that both symptom subtypes were predictive of diet quality, which suggests that both hyperactive/impulsive symptoms and inattentive symptoms are associated with poorer diet quality. Additionally, the high correlation between these symptom subtypes in the present study suggests that in this community sample, it is appropriate to consider ADHD symptoms as a singular construct.

ADHD Symptoms, External Eating, and Diet Quality

As hypothesized, there was a significant main effect of ADHD symptoms on external eating, indicating that teens with higher ADHD symptoms are more likely to eat in response to external cues, such as the sight or smell of food, or being around others who are eating. The direct effect of external eating on diet quality approached significance in the expected direction, suggesting that external eating may be associated with poorer diet quality. There was a small significant indirect effect of ADHD on diet quality through external eating, which suggests that the association between ADHD symptoms and diet quality was partially explained by external eating. This finding is consistent with hypotheses and shows that part of the risk for lower diet quality for individual with ADHD symptoms may be explained by eating due to external cues, rather than internal cues of hunger.

ADHD Symptoms, Peer Problems, and Emotional Eating

The present study sought to explore how experiencing peer problems influences the relation between ADHD symptoms and emotional eating. It was expected that having difficulties with peers would put adolescents with ADHD symptoms at higher risk for emotional eating as a stress reaction and coping response. Bivariate correlations showed that ADHD symptoms, peer problems, and emotional eating were all significantly associated with each other. As predicted, the path model showed a significant moderating effect for peer problems on the relation between ADHD symptoms and emotional eating. For adolescents scoring at about half a standard deviation above the mean on peer problems, ADHD symptoms significantly predicted emotional eating. For adolescents scoring lower than half a standard deviation above the mean on peer problems, there was no significant effect of ADHD symptoms on emotional eating. This finding was consistent with hypotheses that adolescents with higher levels of ADHD symptoms and higher levels of peer problems would be at greatest risk for emotional eating. This study is one of few to consider how a contextual peer variable impacts eating behaviors. ADHD symptoms are highly comorbid with peer problems, and in the present study these two constructs were correlated at r=0.41. Given this strong association, as well as the increased risk for emotional eating shown in the present study, it is crucial that the peer context be considered when examining risk for negative outcomes in individuals with ADHD symptoms, including health-related behaviors and outcomes.

Emotional Eating and Diet Quality

The findings with regard to how emotional eating predicted diet quality in the present study were unexpected. When controlling for external eating, emotional eating had a marginally significant direct effect on diet quality in a positive direction, such that higher emotional eating was associated with higher diet quality. In addition to the marginally significant direct effect, a significant conditional indirect effect was found, such that at higher levels of peer problems (~½ SD above the mean), ADHD symptoms predicted higher diet quality through higher levels of emotional eating. In these direct and indirect effects, emotional eating was associated with diet quality in the opposite direction as hypothesized. This finding is in contrast with prior literature indicating that higher emotional eating results in poorer diet quality, due to increased caloric intake and poor nutritional content of foods typically chosen during emotional eating episodes (Jalo et al., 2019; Macht & Dettmer, 2006; Nguyen-Michel et al., 2007). Given these unexpected results, this finding was further explored in posthoc analyses. Emotional eating has been shown in the literature to be significantly associated with binge eating (Mason & Lewis, 2014; Ricca et al., 2009). Additionally, research has indicated an association between emotional eating and restraint, highlighting potential causal mechanisms as well as neural correlates between these eating behaviors (Van Strien, 2018; Wood et al., 2016).

Given this past research, emotional eating was explored in posthoc analyses in the present study to evaluate whether individuals engaging in emotional eating tended to have inconsistent dietary habits, involving both binge-eating and compensatory behaviors,

such as restraining food intake, between binge-eating episodes. As shown in posthoc analyses, correlations between emotional eating, the dietary restraint subscale score on the TFEQ, and individual binge-eating-related items suggested that these three constructs are positively related in the present study. That is, emotional eating is positively associated with both binge-eating-related items and the restraint subscale. This suggests that emotional eating may be related to an inconsistent dietary pattern that is difficult to capture in a 1-3 day dietary recall procedure, and may result in higher scores due to compensatory restraint associated with binge eating episodes.

This result supports the notion that emotional eating may be associated with a pattern of eating involving both binge-eating and compensatory behaviors, such as dietary restraint, and that dietary recalls may have been completed on days in which adolescents were dieting or restraining their eating, though more research is needed in this area. While the literature on restraint is somewhat mixed, there is some evidence to suggest that dietary restraint is associated with higher diet quality (de Lauzon et al., 2004; Lawless et al., 2020). Therefore, if emotional eaters completed dietary recalls on days they were restraining their food intake, their diet quality may appear higher. Indeed, researchers have found that when examining caloric intake for individuals with and without binge eating, the binge-eating individuals had significantly lower caloric intake than the non-binge-eating group when their self-identified “binge” days were excluded from analyses (Kirkley et al., 1988). This suggests that those who engaged in binge eating on some days tended to consume significantly fewer calories on other days.

Diet Quality and Race

Preliminary analyses revealed an association between race and diet quality when comparing White and non-White participants. The direction of this association was such that non-White participants had significantly lower diet quality scores than White participants. Notably, SES was not associated with diet quality for the overall sample, or within the White and non-White samples, suggesting that although White participants had significantly higher SES than non-White participants, SES may not fully explain this association. In the present study, socioeconomic status was measured using the Hollingshead Four Factor Index, which calculates SES based on parents' marital status, retired/employed status, educational attainment, and occupational prestige (Hollingshead, 1975). While these factors can account for much of what determines and individual's and family's social status and economic wellbeing, there are other factors not captured in this score that may contribute to an individual's access to healthy foods. Past research has also highlighted associations between race and diet quality, independent of socioeconomic status (Bahr, 2007; Forshee & Storey, 2006). The reasons behind this association are likely multifaceted and are not fully understood, though researchers have explored a number of barriers to health equity in racial minority groups, many of which stem from a history of systemic racism (Larson & Story, 2015; Phelan & Link, 2015).

One of these factors is access to healthy food, which can be affected by geographic location and access to grocery stores. Across the US, cities continue to struggle with the presence of food deserts, broadly defined as areas without access to supermarkets or larger grocery stores (Walker et al., 2010). Indeed, in the 2015-2016

Guilford County Community Health Assessment, 24 food deserts were identified in Guilford County (17 of these are in Greensboro). Food deserts are significantly more likely to impact people of color. Evidence has shown that predominantly Black neighborhoods have significantly fewer grocery stores than predominantly White neighborhoods (Galvez et al., 2008; Walker et al., 2010). Additionally, research has shown greater numbers of fast food restaurants and small convenience stores in predominantly Black neighborhoods, which often carry snack food but not a wide array of healthy foods (Hilmers et al., 2012; Morland et al., 2002; Walker et al., 2010). Poorer access to grocery stores and higher access to convenience stores and fast food restaurants has been shown to negatively influence diet quality (Moore et al., 2008; Rummo et al., 2015). For adolescents, considering school location is also important, as school proximity to convenience stores and fast food restaurants has been linked to poorer diet quality, and high schools in lower income neighborhoods have been shown to be in closer proximity to fast food restaurants (He et al., 2012; Simon et al., 2008).

These findings highlight the environmental factors that can influence diet quality for adolescents, and how living in a predominantly Black versus a predominantly White neighborhood is associated with unequal access to healthy foods. When traveling outside of their neighborhood to shop, racial minority individuals may experience discrimination and unfair treatment while shopping, which poses another barrier to equal access to food (Zenk et al., 2014). Indeed, racial discrimination stress has also been associated with poorer diet quality, as well as other negative health-related behaviors that may be used to cope with prolonged stress, such as substance use (Brodish et al., 2011; Sims et al., 2016).

Another factor that can influence diet quality is food marketing, which has been shown to disproportionately target certain racial groups. Black and Latinx youth receive a significantly higher volume of fast-food ads when compared to White youth, and companies selling fast food, soft drinks, and other high caloric density/low nutrient products have been shown to specifically target racial minority groups with their advertising (Adeigbe et al., 2015; Fleming-Milici & Harris, 2018; Grier & Kumanyika, 2008; Powell et al., 2014). Exposure to food advertising has been shown to significantly affect dietary choices for children and adolescents (Cairns et al., 2013; Scully et al., 2012). These factors raise concern that food and beverage marketing strategies are contributing to racial health disparities, and may put non-White adolescents at greater risk for having poorer diet quality.

Food and culture are highly intertwined, and cultural norms with regard to food or weight may also contribute to differences in diet quality across racial groups. Researchers have examined adolescents' attitudes towards eating and body image and found significant differences across racial groups. Black individuals have been shown to have significantly more positive body image, higher body satisfaction, and prefer a bigger ideal body size compared to White individuals (Boyington et al., 2008; Gluck & Geliebter, 2002; Kronenfeld et al., 2010; Mikolajczyk et al., 2012). This suggests that Black individuals may not feel the same pressure to strive for thinness as their White peers, and are happier with their body size (Boyd et al., 2011; Fujioka et al., 2009). Since healthy eating is often seen as a way to stay or become thin, these differences are important to consider when contemplating the motivations behind adolescents' food

choices, as thinness is not an ideal that applies uniformly across racial groups. Finally, some research has suggested that Black individuals associate "healthy eating" with conforming to the dominant (White) culture, and feel that to eat healthily means to give up part of their cultural identity (James, 2004). Furthermore, some traditionally Black dishes have origins in slavery and poverty, and reflect the limited foods and preparation methods that Black individuals have had access to due to racial discrimination and economic disadvantage (Airhihenbuwa et al., 1996; Bailey, 2006). This area of research highlights the importance of cultural sensitivity in dietary interventions, in which cultural attachments to foods are respected and incorporated into diet planning while making healthy adaptations.

Limitations and Future Directions

While the present study had many strengths, including multiple methods of measurement and data collection across two time-points, there are also limitations to consider. The sample size in the present study was limited by the number of adolescents who completed dietary recalls at the age 16 assessment, and was relatively small (n=166). This may have resulted in a somewhat unstable model, as shown by the inconsistency of the significance of parameter estimates in posthoc analyses. Future research should attempt to replicate these findings with a larger sample size. Another limitation of the present study is the use of two time points in the path analysis. This limits the ability to examine true mediation, and future research should examine these constructs across three different time points to determine whether these eating behaviors are mediators in the ADHD/diet quality association. Additionally, while several control variables were

considered in the present study, it was not possible to examine whether participants were taking stimulant medication for ADHD. Since the present study used a community sample and few participants exhibited high levels of ADHD symptoms, this is not expected to have an impact on the outcome of the present study. However, as stimulant medication is an effective treatment to manage symptoms of ADHD, and has side effects that impact appetite and eating, it will be important for research with clinical samples to incorporate this into analyses.

It is important to note that the indirect effects of external eating and the interaction between emotional eating and peer problems were very small, suggesting that there may be other factors that explain this association that were not examined in the present study. One factor that may help explain why adolescents with higher ADHD symptoms have lower diet quality is the influence of peers. While peer influence may have an effect on all adolescents, peer influence may be particularly important for individuals with ADHD. Though susceptibility to peer influence surrounding eating behavior has not been examined, past research has shown that adolescents with ADHD are more susceptible to peer influence regarding alcohol use than their typically-developing peers (Belendiuk et al., 2016). It is possible that individuals with ADHD are also highly susceptible to peer influence regarding dietary habits, though this has not been tested. This influence of peers may be stronger in adolescents with ADHD due to difficulties gaining acceptance from peers, and thus a higher likelihood to copy peers' behavior to gain approval in their social sphere.

Additionally, since the present study showed that adolescents with higher ADHD symptoms are at risk for external eating, the behaviors of peers may be particularly important. Specifically, if peers are engaging in more snacking or intake of high calorie/low nutrient foods, adolescents with ADHD symptoms may be more likely to eat due to these external cues. Peer eating behaviors and dietary intake are interesting and unexplored areas for future research that may give additional insight into contributors to diet quality for adolescents with ADHD symptoms. Future researchers may also want to consider positive peer factors, such as peer support and healthy peer eating, that might also play a role in diet quality for these adolescents.

Another factor not explored in the present study that may be relevant in the ADHD symptoms/diet quality relation is planning. Planning is an important deficit seen in adolescents with ADHD, though was not specifically addressed in the present study. Deficits in planning and organization associated with ADHD may impact meal planning and eating schedule. This may result in skipping meals and overeating at subsequent meals, or may result in choosing fast foods or snacks that are quickly accessible and require less planning, and are typically less healthy. Future studies may want to incorporate a measure of food-specific planning behavior to determine whether poor planning explains part of the association between ADHD symptoms and diet quality in adolescence. Furthermore, this research should consider whether parental or caregiver involvement attenuates the association between ADHD symptoms and poor meal planning, as some parents and caregivers may be more active in packing lunches or cooking meals for their adolescents.

Poor effort allocation is another deficit of ADHD that was not fully explored in this study as it relates to diet quality. Just as individuals with ADHD may find it particularly difficult to complete academic tasks or chores they dislike, they may also find it difficult to consume foods they dislike. Studies in this area may want to incorporate measures of food preference, as prior research has found that higher adolescent taste preferences for fruits and vegetables is positively associated with fruit and vegetable intake (Neumark-Sztainer et al., 2003). However, some adolescents still eat fruits and vegetables even if they do not prefer them. Future research may want to examine whether this is particularly difficult for adolescents with ADHD symptoms, as this may also contribute to our understanding of the relation between ADHD and lower diet quality.

Finally, deficits in attention to food-specific information were not examined in this study. This could include attention to nutritional labels or attention to and awareness of what and how much one is eating. It is possible that these types of food-specific attention deficits could be associated with ADHD and help explain the link with poorer diet quality.

Limitations in Measurement

One limitation in this study was the limited range of data for some constructs. As this is a community sample, the restricted range for ADHD symptoms was expected, though this constitutes a limitation, as few adolescents in the present study exhibited clinical levels of ADHD symptoms. Indeed, only 2 participants in the present sample showed clinically elevated levels of ADHD symptoms based on the questionnaire

responses. This is important to note, as these results may not be generalizable to clinical samples of adolescents with ADHD, and more research within clinical samples is needed.

As for levels of peer problems, only 5 participants fell in the clinically significant range for their levels of peer problems. However, 14 additional participants fell in the at-risk range, suggesting that this sample approximately 12.6% of participants in this sample reported concerning levels of peer problems. Similarly, few adolescents reported high levels of emotional eating and external eating. Of note, the measure for emotional eating and external eating consists of primarily true/false items, which may not effectively assess individuals who are engaging in relevant, but lower severity levels of eating pathology. Furthermore, the Three Factor Eating Questionnaire has primarily been used with adult samples and has not been widely used with adolescents. Future studies may want to utilize other measures to assess these constructs, such as the Dutch Eating Behavior Questionnaire, which uses a Likert scale for participants to rate items and has been used extensively in the literature with adolescent samples (Van Strien et al., 1986). Researchers may also want to employ laboratory measures of eating behaviors, since self-report of eating behaviors is subject to participant bias.

Finally, while the present study utilized individual questionnaire items related to binge-eating in posthoc analyses, future research should incorporated validated measures of binge-eating to better understand the associations between emotional eating, binge eating, restraint, and diet quality for individuals with ADHD symptoms. Other limitations of measurement are discussed in sections below.

Measuring Diet Quality. The Healthy Eating Index is considered an accurate and reliable measure of diet quality and has many strengths, in that detailed data is gathered about food intake and preparation after a 24 hour period by using open-ended questions. However, as with any dietary assessment tool, there are limitations of using this method. Some limitations include underreporting or inaccurate reporting of intake due to social desirability, changes in intake due to increased awareness or self-monitoring of dietary intake, and reliance on the accuracy of participants' memories of food intake (Sherwood, 2008; Willett, 2012). While these factors may impact the accuracy of reporting for dietary intake, these types of limitations apply to many self-report methods of data collection.

As discussed earlier, it is possible that 24-hour dietary recalls may not accurately capture overall diet quality for those who engage in inconsistent dietary behaviors, such as periodic binge eating. In the present study, the positive association between diet quality and emotional eating was surprising. Posthoc analyses revealed that emotional eating is associated with both binge-eating and restraint, suggesting that if dietary recalls were completed on days that these individuals were restraining their eating, their diet quality may appear more positive. Another factor to consider is the potential for shame or embarrassment associated with binge eating to interfere with accurate reporting in dietary recalls. These negative emotions are common after binge-eating episodes, and individuals may omit binge-eating occasions from their self-report if they feel embarrassed or ashamed of their eating, which could result in a diet quality score that is inaccurately high. Another concern for utilizing 24-hour dietary recalls with individuals who engage in

binge eating is the tendency to experience dissociative states during binge eating episodes, which may interfere with accurate memory for food intake (La Mela et al., 2010). Given these findings, it may be important to consider how diet quality is best measured for participants who engage in binge eating. A combination of direct laboratory measurements and dietary recall methods may be a good approach to assess intake directly as well as to assess intake in a naturalistic setting.

It is also important to note aspects of scoring for the HEI, as there is wide variability in how different diet quality scores can be achieved. The total score is comprised of 13 components that are summed. HEI components broadly fall into two categories when scoring the HEI, including 9 adequacy components (with higher scores indicating higher consumption) and 4 moderation components (with higher scores indicating lower consumption). Adequacy components account for 60 out of 100 points on the HEI, while moderation components account for 40 points. Therefore, a participant could still receive a score of 60 if they meet the standards for maximum scores across adequacy components, but exceed recommendations across all four of the moderation components. Therefore, while this measure gives an overall picture of an individual's diet, there are many ways to arrive at a total HEI score. For instance, consuming fruits and vegetables makes up 20 out of 100 possible points on the HEI. Therefore, one could receive an HEI score of 80 without eating any fruits or vegetables, as long as they obtained the highest score in all other areas. Additionally, the HEI components are calculated based on density per 1,000 calories. This enables the HEI to be interpreted similarly across participants without accounting for age, sex, and activity level. However,

there are limitations of this scoring method. Since scores are calculated per 1,000 calories, the HEI score does not reflect the number of calories consumed, but rather the balance among foods in an individual's diet. This indicates that the HEI cannot measure overeating, which constitutes one limitation of this measure. Future studies may benefit from assessing total energy intake in addition to the quality of intake.

Another limitation of the HEI in the present study is the restricted range. HEI scores greater than 80 are considered "good," scores from 51 to 80 are considered "needing improvement" and scores less than 51 are considered "poor." In the present study, the mean score of 48.36 falls into the "poor" range. In the present sample, 58.4% of adolescents scored in the "poor" range based on their HEI score. Only 2 participants (1.2% of the sample) scored in the "good" range. The mean in the present study was slightly lower than that of a nationally representative dataset, in which the average HEI score for adolescents (ages 12-17) was 53 (USDA-FNS, 2013-2014). These findings highlight that the present sample has limitations in range for diet quality; however, low diet quality scores may be representative of adolescents overall in the United States. This indicates that in the present study, higher ADHD symptoms were associated with relatively poorer diet quality, though few participants had "good" diet quality scores.

Measuring Peer Problems. The present study utilized a self-report measure of peer problems due to the availability of data. While an individual's perception of their problems interacting with and garnering support from peers is important, it is also possible that this self-report could be influenced by individual-level factors. While there are advantages of utilizing a self-report measure, in that an adolescent likely has the most

knowledge about their treatment by peers and the impact of this treatment, there are also disadvantages to using self-report. For instance, individuals with higher levels of depressive symptoms may tend to have a poorer outlook on their friendships, or may interpret social interactions more negatively. In fact, in the present study, self-report of peer problems is significantly and strongly associated with self-report of depressive symptoms. Although it would be expected that individuals experiencing peer problems might also be experiencing depressive symptoms, this strong association makes it difficult to distinguish between these two constructs in the present study. It is possible that adolescents reporting higher levels of peer problems are also reporting higher levels of depression due to their experience of peer adversity, or that adolescents experiencing depressive symptoms may be less adept at interacting with peers. However, it may also be that adolescents experiencing depressive symptoms are inaccurately overestimating their peer problems due to negative self-perceptions and self-evaluations. It is not possible to disentangle whether adolescents reporting higher peer problems had a negative bias when evaluating their peer experiences due to depressive symptoms in the present study.

In addition to the limitations of self-report, the present study also faced limitations due to the scale utilized to measure peer problems. Several items on the social stress subscale of the BASC tend to use emotionally laden language (e.g. "Other children are happier than I am," "I am lonely"). Indeed, the social stress subscale loads onto the internalizing problems composite on the BASC, along with three other subscales (anxiety, depression, and sense of inadequacy). This suggests that the social stress scale is prone to

associations with internalizing problems, making it particularly difficult to disentangle peer problems from internalizing symptoms in the present study.

Assessing an adolescent's self-report of their peer experiences is important, though future studies may want to examine other sources of data, such as peer-report, parent-report, or teacher-report. This would provide valuable information regarding the accuracy of adolescents' self-report of peer problems and may help give a less-biased view of an adolescent's level of peer problems, particularly for adolescents experiencing depressive symptoms. However, self-report is still an important and valid measure of peer problems, as an individual's perception of their interactions with peers accurately portrays their personal experience, whether or not this experience is evident to an outside observer. If an adolescent perceives higher peer problems, this suggests that they may be less likely to access peers for support when coping with stress or adversity due to their negative perceptions of peer experiences, regardless of the accuracy of these perceptions.

Developmental Considerations

The present study assessed diet quality at age 16, when adolescents may be gaining more independence over their dietary intake. However, as many adolescents are still living with their parents, there may be variability in how much control adolescents have over what foods are available to them. For some adolescents at this age, parents or caregivers may still be in control of food purchasing, preparation, and portion sizes. In this case, while adolescents may still have some control over how much they eat, they may not have control over what foods they can access or how it is prepared and presented to them. Past research has shown that availability of fruits and vegetables in the home,

eating family dinner together, parental perception of weight, and parental nutrition knowledge can all significantly influence adolescents' diet quality (Adamo & Brett, 2014; Larson et al., 2007; Neumark-Sztainer et al., 2003). Given these factors, future studies may want to examine diet quality in later adolescence or early adulthood, when parents and caregivers may have less direct influence over what foods are available. However, this would not account for the potential lasting impact of how parents and caregivers raise and educate their adolescents about food, which may still be an important factor to consider in future research and interventions.

Another factor that may impact dietary autonomy is whether adolescents have their own spending money or means of transportation, which could impact if and how often adolescents go out to purchase their own food. Some adolescents at this age hold a job, which may not only impact whether they have spending money, but also whether they are at home after school or eating "on the go" at fast food restaurants or other locations. Finally, peers are very important to adolescents at this age, and are often the people with whom adolescents spend most of their time. While the present study examined one aspect of the peer context that may impact eating behavior, there are other factors that were not examined. For instance, it is possible that adolescents are also influenced by their peers' eating behaviors or attitudes about eating. This may be an important avenue for future research.

Summary and Implications

Despite the limitations discussed, the present study provides an important contribution to the literature in improving the understanding of how ADHD symptoms

relate to diet quality. Higher levels of symptoms of ADHD were predictive of lower diet quality over the period of one year, and this association was partially explained by higher levels of external eating. The present study found that adolescents with higher levels of ADHD symptoms who perceive higher peer problems are at higher risk for engaging in emotional eating. While findings regarding emotional eating and the relation with diet quality were less straightforward, this study provides a basis for future studies to examine emotional eating and diet quality for adolescence, with particular attention to potential associations with binge eating and restraint, and a need for multiple methods of dietary assessment. These findings show that adolescents with ADHD symptoms are indeed at higher risk for poorer diet quality, as shown in prior literature. As diet quality is associated with a number of poor health outcomes that contribute to mortality, such as obesity and poor cardiovascular health, it is imperative that researchers and clinicians understand this health risk associated with ADHD symptoms.

As for clinical implications, this study suggests that interventions targeting eating behaviors may be important in helping improve diet quality for adolescents with ADHD. As external eating explained some of the association between ADHD symptoms and diet quality, this may be an important target for intervention. Specifically, adolescents with ADHD symptoms may benefit from learning ways to increase their interoceptive awareness when it comes to hunger cues. This may help them to improve their awareness of sensations that they are hungry or full, and reduce the reliance on external cues for eating. Furthermore, it may be beneficial for adolescents to learn their specific external eating cues so that they can notice when they are in situations in which they are likely to

overeat or eat foods of poor nutritional value. Adolescents may also benefit from a self-monitoring system for dietary intake so that they can better attend to what they have eaten already that day when considering what to eat next. While the findings with regard to emotional eating and diet quality were unexpected, the present study does highlight that peer problems may put adolescents with higher ADHD symptoms at greater risk for emotional eating. Interventions targeting improved peer interactions and coping skills to manage distress associated with peer problems may be beneficial in decreasing the risk for emotional eating.

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APPENDIX A

TABLES AND FIGURES

Table 1
Descriptive Statistics of Categorical Demographic Variables

Variable	N
Sex	
Male	65
Female	101
Race	
White	109
Black	47
More than one	8
Other	2

Table 2
Descriptive Statistics of Continuous Demographic, Independent, and Dependent Variables

Variable	N	Mean	SD	Min.	Max.	Skewness	Kurtosis
SES at 15	147	45.48	13.09	13.50	66.00	-0.74	-0.23
BMI at 15	125	23.61	4.68	15	40	1.39	1.99
ADHD Symptoms	150	0.55	0.42	0	1.97	0.99	0.51
Peer Problems	151	5.52	4.83	0	24	1.26	1.69
Emotional Eating	156	0.21	0.34	0	1	1.40	0.49
External Eating	156	0.25	0.24	0	1	0.96	0.45
Diet Quality	166	48.36	11.15	25.37	88.59	0.19	0.82

Table 3
Correlation Coefficients for Demographic, Independent, and Dependent Variables

Variable	1	2	3	4	5	6	7
1. SES at 15	--						
2. BMI at 15	-.18*	--					
3. ADHD Symptoms	-.21*	-.03	--				
4. Peer Problems	-.13	.10	.41**	--			
5. Emotional Eating	.03	.12	.19*	.23**	--		
6. External Eating	.07	-.03	.24**	.08	.51**	--	
7. Diet Quality	.06	-.15	-.31**	-.07	.06	-.13	--

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

Table 4

Unstandardized Estimates and 95% Bias-corrected Bootstrap Confidence Intervals for Indirect Effects (10,000 draws)

Indirect Effects on Diet Quality	Unstandardized Estimates	Lower CI	Upper CI
ADHD symptoms → External Eating → Diet Quality	-.98*	-2.88	-0.01
ADHD symptoms → Emotional Eating → Diet Quality	0.66	-0.16	2.98
ADHD symptoms X Low Peer Problems → Emotional Eating → Diet Quality	-0.13	-1.90	1.28
ADHD symptoms X Mean Peer Problems → Emotional Eating → Diet Quality	0.66	-0.16	2.98
ADHD symptoms X High Peer Problems → Emotional Eating → Diet Quality	1.44*	0.07	4.56

*Note. *Indirect effect is statistically significant as the bias-corrected 95% confidence interval does not contain 0*

Table 5
Correlation Coefficients for Emotional Eating Posthoc Analyses

Variable	1	2	3	4	5
1. Emotional Eating	--				
2. Go on eating binges	.30**	--			
3. Control and splurge	.27**	.30**	--		
4. Cognitive Restraint	.20*	.18*	.24**	--	
5. Diet Quality	.06	.07	.02	.25**	--

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

Figure 1

Theoretical Model

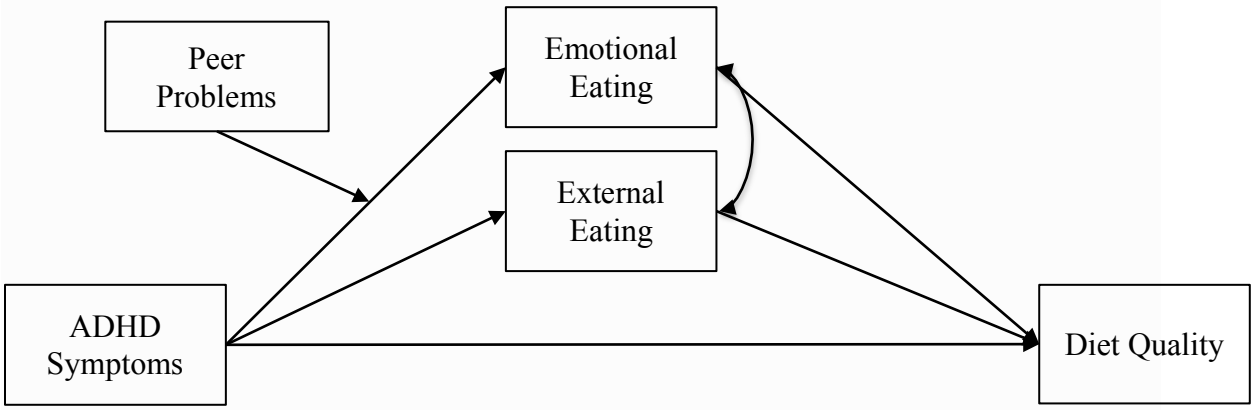


Figure 2

Statistical Model with Race as a Covariate

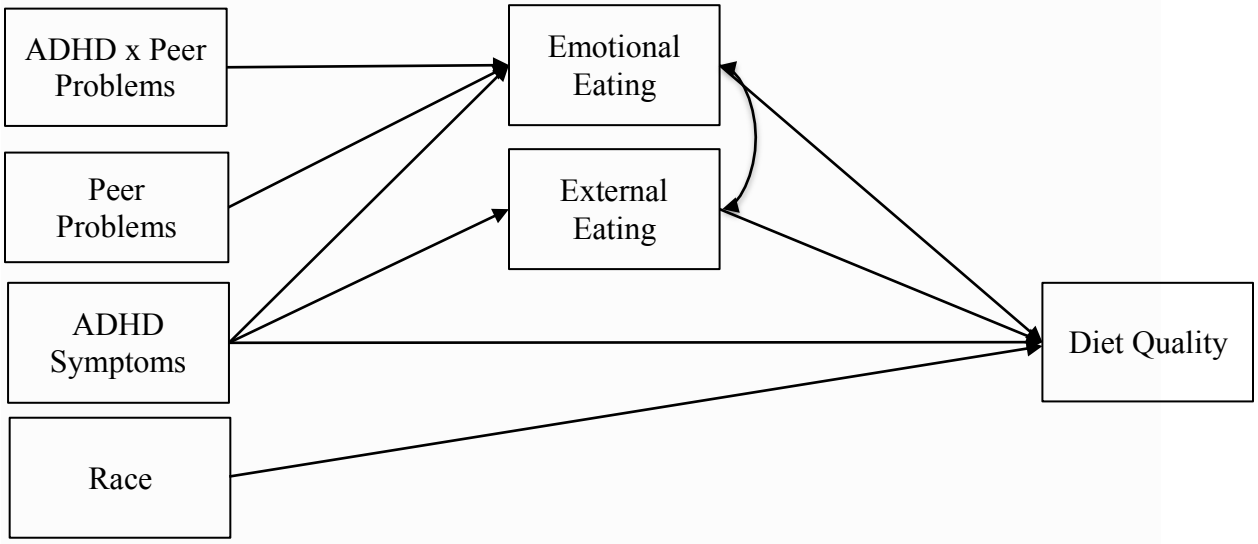


Figure 3

Model with Standardized Path Coefficients

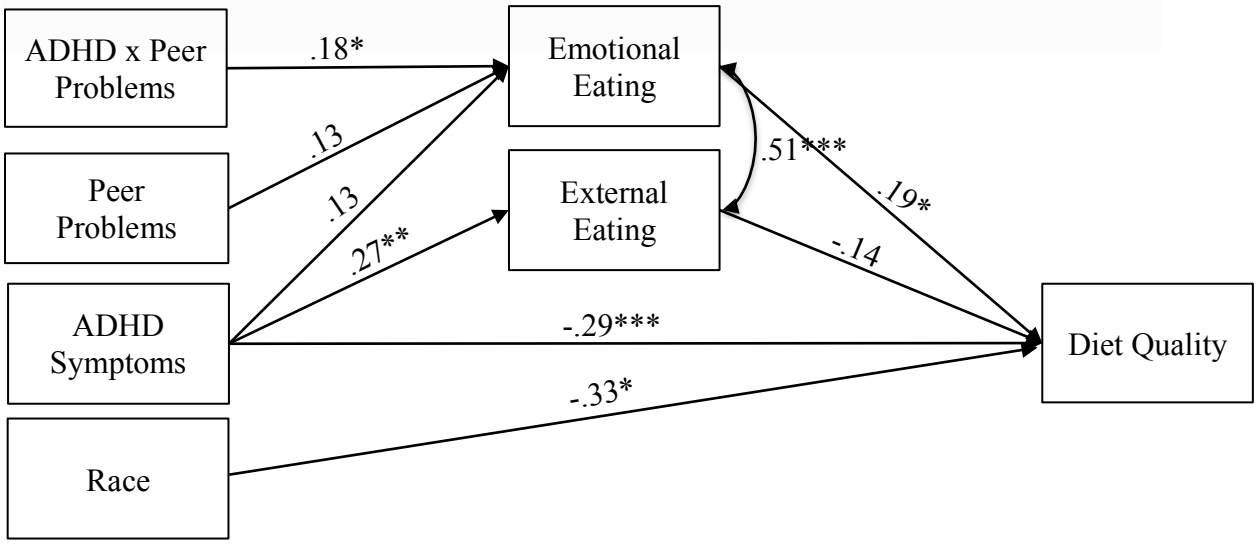
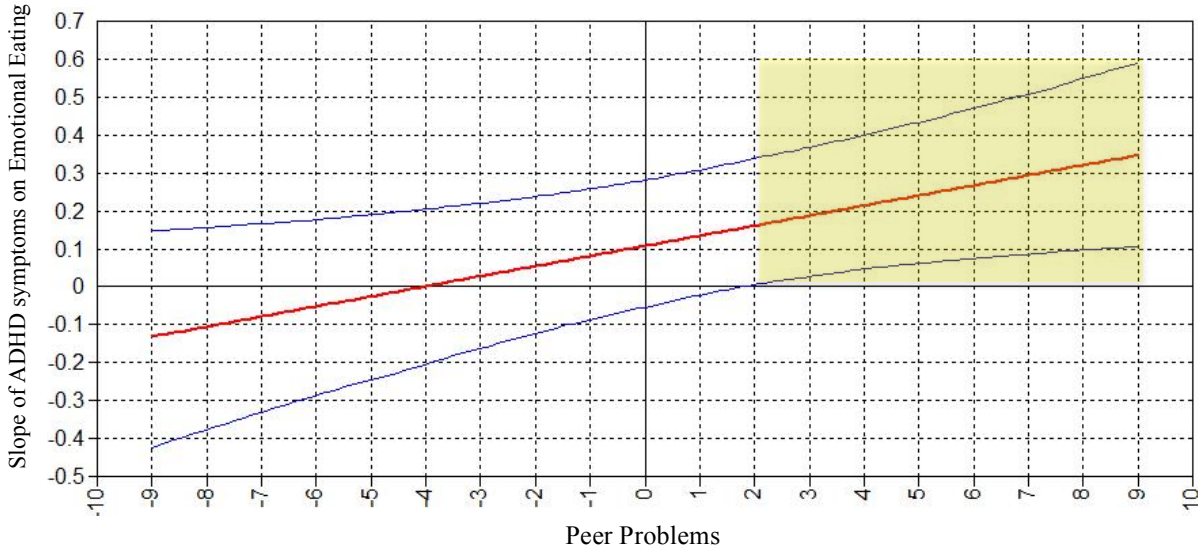


Figure 4

Regions of Significance for the ADHD Symptoms X Peer Problems Interaction



Note: Blue lines represent 95% confidence bands. The area highlighted in yellow indicates the values for which the confidence bands do not include zero and are statistically significant.

APPENDIX B

ADHD RATING SCALE

*Circle the number that best describes **your teen's/your** behavior over the **past 6 months**.*

(0=Never/Rarely, 1=Sometimes, 2=Often, 3=Very Often)

1. Fails to give close attention to details or makes careless mistakes in schoolwork.
2. Fidgets with hands or feet or squirms in seat.
3. Has difficulty sustaining attention in tasks or play activities.
4. Leaves seat in classroom or in other situations in which remaining seated is expected.
5. Does not seem to listen when spoken to directly.
6. Runs about or climbs excessively in situations in which it is inappropriate.
7. Does not follow through on instructions and fails to finish work.
8. Has difficulty playing or engaging in leisure activities quietly.
9. Has difficulty organizing tasks and activities.
10. Is "on the go" or acts as if "driven by a motor."
11. Avoids tasks (e.g., schoolwork, homework) that require sustained mental effort.
12. Talks excessively.
13. Loses things necessary for tasks or activities.
14. Blurts out answers before questions have been completed.
15. Is easily distracted.
16. Has difficulty awaiting turn.
17. Is forgetful in daily activities.
18. Interrupts or intrudes on others.

APPENDIX C

THREE FACTOR EATING QUESTIONNAIRE

EMOTIONAL EATING SUBSCALE

Please place a check in the appropriate column to indicate whether each statement is true or false.

9. When I feel anxious, I find myself eating.

20. When I feel sad or down, I often overeat.

27. When I feel lonely, I make myself feel better by eating.

APPENDIX D

THREE FACTOR EATING QUESTIONNAIRE

EXTERNAL LOCUS FOR HUNGER SUBSCALE

Please place a check in the appropriate column to indicate whether each statement is true or false.

8. Since I am often hungry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat.

19. Being with someone who is eating often makes me hungry enough to eat also.

22. When I see something really delicious or yummy, I often get so hungry that I have to eat right away.

26. I am always hungry so it is hard for me to stop eating before I finish the food on my plate.

Please answer the following questions by <u>circling</u> the number of the response that is appropriate to you.

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

1	2	3	4
easy	slightly difficult	moderately difficult	very difficult

47. How frequently do you skip dessert because you are no longer hungry?

1	2	3	4
almost never	seldom	at least once a week	almost every day

APPENDIX E

BEHAVIOR ASSESSMENT SYSTEM FOR CHILDREN-2, SELF REPORT FORM, ADOLESCENT

SOCIAL STRESS SUBSCALE

My friends have more fun than I do.	T F
Other children are happier than I am.	T F
I am left out of things.	N S O A
I am lonely.	N S O A
I feel out of place around people.	N S O A
I feel that others do not like the way I do things.	N S O A
Other people are against me.	N S O A
Other people find things wrong with me.	N S O A
People act as if they don't hear me.	N S O A
People say bad things to me.	N S O A