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Exploration of food addiction in pediatric patients: A preliminary investigation

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Abstract

Objectives—The goals of the present study were to explore the possibility that symptoms of food addiction may exist for some children and to identify factors that may be associated with pediatric food addiction.

Methods—Participants were 50 children (aged 8-19), recruited from the Pediatric Lipid Clinic at a large southeastern teaching hospital, and their parent/guardian. Participants completed questionnaires to assess food- and eating-related attitudes and behaviors, as well as symptoms of food addiction.

Results—Parent- and child-reported behaviors and attitudes demonstrated similar patterns. Child BMI ratings were significantly correlated with overeating ($r = .42, p = .02$) and emotional eating ($r = .33, p = .04$). Of note, 15.2% of children indicated that they “Often,” “Usually,” or “Always” think that they are addicted to food, and an additional 17.4% reported that they “Sometimes” feel that way. Food addiction symptoms were significantly correlated with child overeating ($r = .64, p < .001$), uncontrolled eating ($r = .60, p < .001$), emotional eating ($r = .62, p < .001$), food preoccupation ($r = .58, p < .001$), overconcern with body size ($r = .54, p < .001$), and caloric awareness and control ($r = -.31, p = .04$).

Conclusions—Results of the present study suggest that “food addiction” may be a real problem for a subset of children who suffer from overweight/obesity. Identification of food addiction may improve obesity treatment efforts for this subset of patients.

Keywords

Food addiction; Obesity; Children; Adolescents

The prevalence of pediatric overweight and obesity has risen substantially across recent decades, with some estimating the increase in pediatric obesity to be between 200-400% since the mid-to-late 1990's¹. This rise is especially concerning because obesity is known to be associated with numerous medical, psychological, and social problems, which can be exacerbated in children and adolescents². Health consequences of overweight include liver disease, sleep apnea, joint pain, impaired mobility, and fractures of the bone³, and two of the

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most commonly documented hazards of obesity are metabolic syndrome (i.e., insulin resistance, type 2 diabetes, polycystic ovary syndrome, dyslipidemia) and increased risk for cardiovascular disease in adulthood^{4,5}. In fact, one study of American adolescents showed that 89% of overweight teens had at least one irregular metabolic indicator⁶, and another study of 500 American children and teens revealed the presence of a metabolic syndrome in nearly 50% of children whose BMI was greater than 99% of the population⁷. In addition to the innumerable physical health problems, several psychological and behavioral problems are also linked to obesity. Children and adolescents who are overweight generally display more behavioral and self-esteem problems than their peers of normal weight, and show higher incidences of depression and impaired social functioning^{8,9,10}. Unfortunately, the consequences of childhood obesity appear to extend to adulthood as well. A 20-year prospective study demonstrated a connection between childhood obesity and depression/aggression in adulthood¹¹. Studies have also demonstrated that those who binge eat as youth have an increased risk for substance-abuse in adulthood and are more likely to have relatives with addiction disorders¹².

Identifying the causes of obesity in pediatric patients can be challenging. Routine screening for risk factors of pediatric obesity is infrequent (and generally limited to an annual well-child visit). In addition, treatment for overweight/obesity is only provided to a small number of children, due to low treatment availability and high costs². Although diet and exercise are generally targeted, addiction to food has recently been identified as an additional potential factor contributing to the rise in obesity¹³. Though still a theoretical concept, there are several factors which may play a role in the development of food addiction. Indeed, the mechanisms (including genetics, environmental influences, social learning, and neurobiological factors) contributing to food addiction are being compared to those that influence addiction to drugs².

With regard to hereditary factors, research suggests that children born to parents who are overweight are more likely to become overweight themselves, and are at higher risk for obesity throughout their lives. In fact, some studies show as much as 60% of one's vulnerability for obesity can be attributed to genetics¹³. Researchers who examined concordance rates of obesity in identical twins found that similarities in degree of overweight were twice as high for identical twins as they were for fraternal twins¹⁴. Stunkard et al.¹⁴ also found in their twin studies that weight, height, and Body Mass Index (BMI) were highly correlated across time, suggesting that genetics play a large role in that co-variation. In addition, just as inherited factors (i.e., mechanisms involved in drug absorption and metabolism) may enhance a person's vulnerability to substance abuse¹⁵, similar factors may affect individuals' response to food. Kampov-Polevy and colleagues¹⁶ reported that family history of alcohol dependence is also associated with increased preference for sweetness, suggesting similar genetic mechanisms that could contribute to both alcohol and high-sugar food addictions. In addition, Tsuang et al.¹⁵ assert that, since genes have been shown to affect certain areas of personality, personality may also influence an individual's potential to become addicted due to variations in the degree to which an individual finds a substance (or, in this case, food) pleasant.

Although genetics play a role in addiction, most experts agree that environmental factors also contribute significantly to the development of addiction¹⁷. Regardless of whether the substance of abuse is food or a drug, some believe that the probability of developing an addiction disorder is influenced significantly, and possibly equally, by both genetic and environmental factors^{17,18}. For example, the increased availability of high-fat high-calorie foods and the extensive advertising of sugary foods to children can greatly impact their food selection and the development of pediatric obesity¹⁹. Public health initiatives designed to limit the marketing of low-nutrition foods may decrease overconsumption of these products, in the same way that public health interventions have targeted tobacco and alcohol marketing to reduce

consumption. Like substance use, compulsive eating may also be influenced by social factors, with children learning over-eating habits by observing their parents and peers. Most individuals initially obtain substances of abuse from family or friends, and model behaviors they have witnessed by these individuals²⁰. Finally, studies have shown that children who experience high levels of stress and anxiety are more likely to develop disordered eating, and particularly compulsive overeating, by turning to food to relieve their worries²¹. Just as an individual who suffers from drug addiction may turn to drug use as a coping mechanism, some individuals who “abuse” food report using it in order to manage difficult situations, relationships, and negative affect. In humans, the literature shows that few people (~30%) experience a decrease in food intake during times of stress; whereas, the majority of individuals increase their food intake when experiencing stress²¹. As children’s lives become more fast-paced, complicated, and competitive, they may increasingly turn to food in order to help relieve their stress.

From a neurobiological perspective, evidence is accumulating to show that food addiction and drug addiction are closely related conditions²². Prominent scientists have hypothesized that the biological mechanisms of feeding and addiction have overlapped throughout evolutionary history¹³. Indeed, appetitive drive for food and craving for drugs purportedly share overlapping and interactive pathways in the brain, especially in the hypothalamus, which is involved in food regulation and energy expenditure². In addition, both food and drugs are associated with activation of the dopamine-based reward system within the brain. When an individual anticipates the ingestion of food, the body experiences an increase in the extracellular level of dopamine in the nucleus accumbens, just as the body would experience in anticipation of other substances of abuse²³. Dopamine D2 receptors are responsible for mediating reinforcing responses, so obesity can be seen as a “reward deficiency syndrome”²³. When individuals experience decreased levels of dopamine, this triggers feeding behaviors in order to restore levels of dopamine in the brain²³. However, as animal research has demonstrated,²⁴ a “tolerance” can develop such that, when the individual ingests excessive amounts of fat- and sugar-rich foods, the body craves more and more to satisfy the hunger, just as with drugs of abuse.

Despite the many consequences of pediatric obesity and the similarities between drug abuse and excessive food consumption, most clinicians do not screen for the presence of food addiction when evaluating patients or developing a treatment plan. This is not unexpected, as currently there is no accepted definition or diagnostic criteria for food addiction. There are limited data regarding the phenomenology of food addiction in adult patients, but virtually no work has been done in this area for pediatric patients. The present study was designed as a preliminary investigation to explore the possibility that symptoms of food addiction may exist for some individuals beginning in childhood. The goal of the study was to identify factors that may be associated with food addiction during childhood, in order that effective interventions might be developed for this subset of patients.

Methods

Participants

Participants were 50 children, recruited from the Pediatric Lipid Clinic at a large southeastern teaching hospital, and their parent/guardian. The children (64% female) ranged in age from 8 years, 4 months to 19 years ($M = 13.8$ years, $SD = 2.7$ years), and self-identified as Caucasian (60%), African American (24%), Hispanic (6%), Asian (2%), American Indian/Alaska Native (2%), or Other (6%). Children were referred to the Lipid Clinic due to problems associated with overweight/obesity or other metabolic conditions (e.g., hyperlipidemia, type II diabetes, etc.). Body Mass Index (BMI) ratings for children were calculated using the Centers for Disease Control (CDC) BMI Calculator for Child and Teen individuals (<http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx>). Based on this calculator, BMI ratings for

children were capped at a maximum of 51.5. The children in this study had a mean BMI rating of 35.6 ($SD = 10.6$), ranging from 19.0 to 51.5. The CDC calculator further classifies children based on their BMI percentile, which is adjusted for age and gender (i.e., underweight = less than 5th percentile, healthy weight = 5th to less than 85th percentile, overweight = 85th to less than 95th percentile, and obese = 95th percentile or greater).

The parent/guardians (87% female) ranged in age from 30-65 years ($M = 43.2$ years, $SD = 7.0$ years). The BMI ratings for parents were computed using the Centers for Disease Control Adult BMI Calculator (http://www.cdc.gov/nccdphp/dnpa/healthyweight/assessing/bmi/adult_BMI/english_bmi_calculator/bmi_calculator.htm). Ratings of BMI for the parents ranged from 15.5 to 57.3 ($M = 33.0$, $SD = 9.4$). Approximately 68% of parents reported being currently married, with 21% divorced, 7% never married, and 4% widowed. Families reported average annual income ranging from less than \$15,000 to \$200,000 ($M = \$46,700$, $SD = \$41,322$).

Measures

Eating Attitudes Test (EAT)^{25,26}—The EAT is a 26-item measure, scored on a 6-point Likert-type scale. It assesses attitudes towards food and personal eating behaviors. Sample items include “I take longer than others to eat my meals” and “I feel extremely guilty after eating.” The EAT also contains 4 questions assessing history of eating disorder behavior, including questions about bingeing, purging, using pills to control weight, and history of treatment for an eating disorder. The measure yields a total score, as well as subscale scores for Dieting, Food Preoccupation, and Oral Control. The EAT has demonstrated good psychometric properties²⁷.

Children’s Eating Attitudes Test (ChEAT)²⁸—The ChEAT is a 26-item children’s version of the EAT, which was developed to assess children’s attitudes regarding food and eating. Items such as, “Scared about being overweight” and “Others pressure me to eat” are scored on a 6-point Likert-type scale. The ChEAT yields subscale scores for Overconcern with Body Size, Dieting, Food Preoccupation, Social Pressure to Gain Weight, Vomiting, and Caloric Awareness & Control. The ChEAT has demonstrated good psychometric properties.^{28,29} For this study, the ChEAT was scored according to guidelines developed by Anton and colleagues³⁰ (who advocated use of the entire 6-point scale, rather than the abridged 3-point scale) in order to retain the greatest possible variability in scores.

Three Factor Eating Questionnaire (TFEQ)³¹—The TFEQ is an 18-item questionnaire, scored on a 4-point Likert-type scale. It assesses eating patterns in adults and children across three separate factors: cognitive restraint, uncontrolled eating, and emotional eating. Sample items include, “I deliberately take small helpings as a means of controlling my weight,” and “Sometimes when I start eating, I just can’t seem to stop.” The TFEQ has demonstrated good psychometric properties.³²

Inventory of Overeating Situations (IOS)—The Inventory of Overeating Situations was adapted, with permission, from the Inventory of Drinking Situations (IDTS)³³ in order to assess situations in which unhealthy overeating is more likely to occur. Both assessments contain 50 items and are scored on a 4-point Likert-like scale. The IDTS measures situations that trigger excessive alcohol use. These questions, such as “I drank when I had trouble sleeping” and “I drank when I was lonely” were modified to deal with food and eating, for example, “I overate when I had trouble sleeping” and “I overate when I was lonely.” For the present samples, internal consistency ratings were excellent ($\alpha = .99$ for the parent sample and $\alpha = .98$ for the child sample).

Eating Behaviors Questionnaire (EBQ)—The Eating Behaviors Questionnaire was created for this study. It is a 20-item measure (see table 1) of hypothesized symptoms of food addiction, which are based on adaptations of DSM-IV³⁴ criteria for substance abuse and dependence. The measure was developed to have high face validity, and includes questions assessing the “3 Cs” of addiction (i.e., Compulsive use, attempts to Cut down, and continued use despite Consequences). Parallel forms were used for parents and children, with wording of items altered for easier comprehension in the child sample. Items are scored on a 6-point Likert-type scale ranging from 1 = “Never” to 6 = “Always,” with higher scores indicative of greater symptoms. Sample child items include “Do you spend more time eating than you mean to?” as well as, “Do you eat more food than you mean to?” and “Do you try to cut down on your eating?” and “Have you gotten into trouble because of your eating?”. For the current samples, internal consistencies were high ($\alpha = .84$ for the parent sample and $\alpha = .88$ for the child sample).

Procedures

All procedures were approved by the appropriate Institutional Review Board. Families who were being evaluated by physicians at the Pediatric Lipid Clinic were approached in the waiting room and asked if they would like to participate in a study assessing eating attitudes and behaviors among children and their parents. After obtaining written consent from the parent and written assent from the child, a trained research assistant provided the families with a packet of questionnaires to complete. Both parents and children provided demographic information and completed the EAT (or ChEAT), the TFEQ, the IOS, and the EBQ. The research assistant was available to answer questions, but allowed families to complete packets independently.

Data analysis

In order to address isolated cases of missing data, mean substitution was utilized to fill in missing data points when the individual had completed at least 80% of items for a given subscale. Pearson product-moment correlations were computed to assess for significant relationships among variables of interest. Statistical significance was set at $\alpha = .05$. A priori research questions included: 1) assessment of correlations among parent and child scores for the same variables, 2) evaluation of the association between various eating behaviors and attitudes with BMI ratings for pediatric patients, and 3) exploration of eating behaviors and attitudes associated with self-endorsed symptoms of food addiction among pediatric patients.

Results

Parent-child similarities

Parent- and child-reported behaviors and attitudes demonstrated similar patterns across the study variables of interest. For example, on the Inventory of Overeating Situations (IOS), children’s and parents’ scores were significantly correlated ($r = .54, p = .001$). Similarly, children’s total scores on the Three Factor Eating Questionnaire (TFEQ) correlated significantly with parent total scores on the same measure ($r = .28, p = .05$). Subscale scores demonstrated less consistency, with a significant correlation for the Emotional Eating subscale ($r = .29, p = .05$), but not the Cognitive Restraint ($r = .21, p = .15$) or Uncontrolled Eating ($r = .21, p = .15$) subscales. The children’s total scores on the ChEAT were significantly related to the parents’ scores on the EAT ($r = .39, p = .009$). And, child scores on the ChEAT Dieting subscale correlated significantly with parent scores on the EAT Diet subscale ($r = .30, p = .05$). However, child and parent scores on the ChEAT and EAT Food Preoccupation scale were not significantly related ($r = -.04, p = .77$), and children’s ChEAT Caloric Awareness and Control scores were not significantly correlated with parent EAT Oral Control scores ($r = .15, p = .31$).

Correlates of child BMI

BMI ratings were available for 40 children and 45 parents, so all analyses involving BMI ratings are based on this subsample of participants only. The correlation among parent and child BMI ratings for the present sample was $r = .32$ ($p = .05$). Child scores on the IOS were also associated with child BMI ratings ($r = .42$, $p = .02$), as were child scores on the TFEQ Emotional Eating subscale ($r = .33$, $p = .04$). In addition, the correlations among child BMI ratings and their scores on the Eating Behaviors Questionnaire (EBQ) and the ChEAT Social Pressure to Gain Weight subscale were relatively large, but did not reach statistical significance ($r = .31$, $p = .06$ and $r = -.30$, $p = .07$, respectively). Child scores on the TFEQ Cognitive Restraint and Uncontrolled Eating subscales were not related to BMI ($r = .12$, $p = .48$ and $r = .04$, $p = .83$, respectively).

Correlates of food addiction symptoms

The range of possible scores on the children's EBQ ranges from 20-120. In this sample, children reported a mean score of 51.6 (SD = 15.6), with a range from 27 to 104. Among children, the most commonly-endorsed items were representative of compulsive eating and lack of control (e.g., "Do you wish you could eat if you have not eaten in a while?" "Do you want to cut down on your eating?" and "Do you try to cut down on your eating?"). The least-commonly-endorsed symptoms among children included, "Do you miss out on activities because of your eating?", "Do you ever fight with your family, friends, or others about your eating?" and "Do you save up or hide food?" Similarly, among parents, the most commonly-endorsed items were, "Do you find that you start to 'crave' food if you have not eaten in a while?", "Do you want to cut down on your eating?" and "Do you try to cut down on your eating?" The least commonly-endorsed items for parents were included, "Do you miss social or work activities because of your eating?", "Do you try to eat in places where eating is prohibited?" and "Have you had legal problems related to your eating (e.g., stealing food, fighting with others over food)?".

When examining correlates of children's self-reported food addiction symptoms (i.e., child EBQ Total scores), several significant relationships emerged. As expected, food addiction symptoms were significantly correlated with child scores on the IOS ($r = .64$, $p < .001$), the TFEQ Total Score ($r = .57$, $p < .001$), the TFEQ Uncontrolled Eating subscale score ($r = .60$, $p < .001$), the TFEQ Emotional Eating subscale score ($r = .62$, $p < .001$), and the ChEAT Food Preoccupation ($r = .58$, $p < .001$), Overconcern With Body Size ($r = .54$, $p < .001$), and Caloric Awareness & Control ($r = -.31$, $p = .04$) subscales. There was a non-significant trend in the inverse relation between children's EBQ scores and their scores on the TFEQ Cognitive Restraint subscale ($r = -.27$, $p = .07$). The children's EBQ scores were not significantly correlated with ChEAT Dieting ($r = -.13$, $p = .39$), Social Pressure to Gain Weight ($r = -.24$, $p = .11$), or Vomiting ($r = -.16$, $p = .29$) subscale scores. It is also noteworthy that 15.2% of children responded "Often," "Usually," or "Always" to the question, "Do you think you are addicted to food?", and an additional 17.4% reported that they "Sometimes" feel that way.

Discussion

Pediatric obesity is a significant public health concern that has grown rapidly over the past several decades³⁵. Though many factors contributing to pediatric obesity have been identified, including poor diet with sedentary lifestyle³⁶, hereditary factors¹³, and family influences³⁷, more information is needed to understand this condition, in order to develop more effective prevention and treatment programs. Results of the present study suggest that children's attitudes and beliefs related to food, dieting, and weight management are associated with their level of overweight/obesity. In addition, symptoms of compulsive eating behaviors or "food addiction" may contribute to these problems in some children.

Consistent with previous research^{38,39}, children's eating-related attitudes and behaviors generally correlated significantly with their parents' eating-related attitudes and behaviors. Though these data may provide additional support for the contribution of hereditary factors to the development of obesity, they also provide evidence that overeating may be a learned behavior. Just as most individuals with a substance use disorder first acquire drugs of abuse from friends or family²⁰, children may learn to acquire excessive amounts of food and abuse food through social learning, by observing their parents overeat throughout their lifespan.

In addition, the present study provides a preliminary downward extension of the pioneering work on food addiction that has been conducted in other populations. Animal studies^{40,41} and adult human studies^{42,43} have provided support for this concept by demonstrating neurobiological mechanisms that might account for food addiction, and by demonstrating that humans can validly and reliably self-report symptoms of food addiction. However, we were not aware of any studies that investigated the presence of food addiction symptoms, and their correlates, among children. Results of the present study suggest that some children report experiencing a compulsion to eat, which they describe as feeling like an "addiction." In addition, the measure of food addiction symptoms (i.e., Eating Behaviors Questionnaire [EBQ]) demonstrated good construct validity in this pediatric sample, with significant correlations between the EBQ and measures of uncontrolled eating, emotional eating, food preoccupation, body size concerns, and attempts at calorie control.

In general, the present study provides preliminary support for the concept of food addiction among pediatric patients. However, results should be evaluated within the context of several limitations. First, the sample was relatively small and consisted primarily of children who were obtaining medical treatment due to symptoms of overweight/obesity. As a result, the generalizability of the results to the population as a whole is unknown. In addition, some of the analyses were likely underpowered, in particular the analyses involving BMI ratings (which utilized a lower n). Next, restriction of range in the BMI ratings for these patients (i.e., the BMI ratings were heavily skewed on the obese end of the spectrum) likely attenuated the significance of the correlations between eating attitudes, behaviors, and food addiction symptoms with BMI. The use of self-report measures should be taken into consideration, as individuals may not have good insight into their symptoms (i.e., some may overidentify themselves as "addicts;" whereas, others may exhibit "denial" of their symptoms). More research is needed to verify the reliability and validity of this assessment approach. In addition, food addiction remains a theoretical construct at this point, with no accepted diagnostic criteria. As a result, no validated measure of food addiction was available in the literature, so food addiction symptoms were assessed using a questionnaire developed specifically for this study. Though preliminary psychometric properties appear promising (e.g., good internal consistency and concurrent validity in this sample), more research is needed to fully evaluate the utility of this measure.

Future research should seek to replicate the current findings and extend the investigation to a more diverse sample of individuals. Once standardized diagnostic criteria are identified, children who demonstrate symptoms of food addiction should be further evaluated in order to identify ways to develop effective prevention and intervention programs for this population. For example, if individuals experience compulsive overeating as a type of addictive behavior, various preventive efforts might be indicated such as limiting access to high-fat, high sugar foods (i.e., vending machines in schools), providing educational programs designed to help children develop a healthy relationship with food, and mental health treatment for stress/anxiety/depression that might trigger compulsive eating. From an intervention perspective, treatment approaches utilized in substance abuse treatment (e.g., motivational interviewing, cognitive-behavioral therapy, contingency management, participation in 12-step programs) might be emphasized more strongly as alternatives to traditional "dieting," which has demonstrated very limited success with this population.

Conclusions

Results of the present study suggest that “food addiction” may be a real problem for a subset of children who suffer from overweight/obesity. Given that self-reported symptoms of food addiction were associated with overeating, uncontrolled eating, emotional eating, and BMI ratings, identification of food addiction symptoms may lead to the development of improved obesity treatment methods for this subset of patients. More research is needed to clarify the nosology of food addiction, to develop appropriate screening measures, and to better understand the emotional and behavioral correlates of this problem.

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Table 1
Children's Eating Behaviors Questionnaire Items

1	Do you eat more food now than you used to?
2	Do you think eating is less fun than it used to be?
3	Do you wish you could eat if you have not eaten in a while?
4	Do you eat more food than you mean to?
5	Do you spend more time eating than you mean to?
6	Do you want to cut down on your eating?
7	Do you try to cut down on your eating?
8	Do you spend a lot of time getting food (asking for food, making snacks)?
9	Do you spend a lot of time eating during the day?
10	Do you spend a lot of time "recovering" after you eat (resting, feeling too full to do anything)?
11	Do you miss out on activities because of your eating?
12	Do you eat foods that you know are bad for you and you aren't supposed to eat?
13	Do you eat too much food even when you know you aren't supposed to?
14	Do you feel upset or sad about your eating habits?
15	Do you eat even when you know you could get into trouble?
16	Do you try to eat in places where eating is not allowed?
17	Have you gotten in trouble because of your eating?
18	Do you ever fight with your family, friends, or others about your eating?
19	Do you save up or hide food?
20	Do you think you are addicted to food?
