



Commentary

'Food addiction'. What happens in childhood? ☆

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The term *food addiction*, which refers to eating behavior involving the overconsumption of specific foods in an addiction-like manner, has been used in the scientific community for decades (Hinkle, Knowles, Fischer, & Stunkard, 1959; Randolph, 1956). However, studies aimed at proving or disproving the validity of this concept remained rare in the 20th century. Mainstream media and scientific attention has dramatically increased in recent years (Davis & Carter, 2009; Gearhardt, Davis, Kuschner, & Brownell, 2011; Moss, 2013). The concept of having an addiction to food parallels diagnostic criteria of substance use disorders (such as addiction to alcohol, tobacco, cocaine, and other substances) and features overconsumption of highly palatable, high-caloric foods (Barry, Clarke, & Petry, 2009; Gearhardt, Corbin, & Brownell, 2009b; Gearhardt, White, & Potenza, 2011). Part of the growing body of research pertaining to food addiction includes the increasing variety and availability of energy dense, nutrient poor foods. These extra/discretionary foods may have an addictive potential as a result of increased potency due to certain nutrients or additives (Ifland et al., 2009).

To date, the media attention and research pertaining to food addiction has been focused in adults. Moreover, food addiction has largely been a self-identified and self-reported condition, which has limitations in regard to the reliability and validity of reporting. Currently, 'food addiction' has no formally recognized definition;

it is typically described and established according to principles established from the *Yale Food Addiction Scale* (YFAS). The YFAS was developed in 2009 and is the only tool available to assess symptoms that in combination may resemble an addiction to certain foods. The YFAS is a questionnaire in which individuals self-report their post food consumption emotional state, physical responses, attitudes toward food and eating and potential professional or social implications of addictive food behaviors (Gearhardt, Corbin, & Brownwell, 2009a). The YFAS is based upon substance dependence criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) and scales used to assess behavioral addictions such as gambling. In adults, prevalence rates of "food addiction" have been recently systematically reviewed with diagnosis using the YFAS having a weighted mean value of 19.9% ranging between 5.4 and 56.8% with higher values found for females, those classified as overweight or obese and those with binge eating disorder or bulimia nervosa (Meule & Gearhardt, 2014a; Pedram et al., 2013; Pursey, Stanwell, Gearhardt, Collins, & Burrows, 2014). The YFAS has been previously shown to have high internal reliability and convergent validity in adults with other established self-reported eating pathology measures (Gearhardt et al., 2009a; Meule & Gearhardt, 2014a). Very few studies have investigated correlates of the YFAS with objective measures such as behavioral tasks or neuroimaging. One previous study included functional brain imaging in female adults only (Gearhardt et al., 2011) while another investigated impulsive reactions in response to food-cues in female students (Meule, Lutz, Vögele, & Kübler, 2012). A few studies examined associations with genetic markers of dopamine or opioid signaling (Davis & Loxton, 2014; Davis et al., 2013) or appetite changes following a methylphenidate challenge (Davis, Levitan, Kaplan, Kennedy, & Carter, 2014). These studies showed that a subgroup of individuals who exhibit

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addiction-like eating show distinct neuronal or behavioral responses to high-calorie food cues. However, reviews in this area show that the majority of published studies are cross-sectional in design and have studied correlates of the YFAS based on self-reports only (Meule & Gearhardt, 2014a; Pursey et al., 2014). Thus, although there has been a substantial increase in research on food addiction in recent years, sophisticated study approaches that include, for example, experimental or longitudinal field studies, which examine neuronal and behavioral correlates of the YFAS, are urgently needed.

Food addiction in children and adolescents

There is a paucity of research exploring the phenomenon of food addiction in children. Existing studies are limited in nature though they demonstrate evolution in research integrity over time. A total of four studies were identified including three quantitative studies with a total of 175 participants (range 50–75) and one qualitative study with $n = 29,406$ participants. A study conducted in 2009 was limited in the assessment of food addiction through use of a non-validated, self-made questionnaire (Merlo, Klingman, Malasanos, & Silverstein, 2009). For instance, this questionnaire included the question, “do you think you are addicted to food?” which is susceptible to bias. This was followed in 2011 with a broad qualitative exploration study using messages and polls from a teenage webpage acting as an overweight intervention (Pretlow, 2011). In 2013, a study in obese adolescent inpatients of a weight-loss clinic ($N = 50$; age range 14 to 21 years) used the adult version of the YFAS (Meule, Hermann, & Kübler, 2013). It was found that 38% of this sample received a “food addiction diagnosis”, which parallels findings from similar samples in adults (Meule & Gearhardt, 2014a).

In 2013, the YFAS was revised to lower the reading level and incorporate parental prompts with 25 questions, which map onto the seven diagnostic criteria for substance dependence of the DSM-IV and clinically significant impairment/distress related to eating behavior. In the validation study including $n = 75$ children aged 4 to 16 years from a range of ethnicities, addictive eating patterns, as measured by the child version of the YFAS (YFAS-C), were related to elevated body mass index (BMI; Gearhardt, Roberto, Seamans, Corbin, & Brownell, 2013). Prevalence of food addiction in children was reported as 7%. These results need to be replicated in larger cross-sectional surveys, and include variables such as weight status and gender to ascertain if similar relationships exist in pediatric population when compared with adults.

It is to the authors' contention that food addiction research continue to be extended into pediatric populations, given the alarming increase in childhood obesity rates. In children and adolescents in developed countries, 23.8% of boys and 22.6% of girls were overweight or obese in 2013 (Ng et al., 2014). Obesity in childhood is associated with short and long-term adverse health consequences (Hughes, Farewell, Harris, & Reilly, 2007) and is problematic as it often tracks to adulthood (Biro & Wien, 2010). Most short-term consequences cluster and become risk factors for chronic disease including heart disease, type 2 diabetes and some cancers. The World Cancer Research Fund's number one strategy to prevent cancer is to achieve and maintain a lifetime healthy body weight (Norat, Aune, Chan, & Romaguera, 2014).

Most childhood obesity interventions to date have demonstrated some effectiveness in achieving weight loss, albeit studies are limited (Collins, Warren, Neve, & Stokes, 2006; Ho et al., 2013). Diet and exercise are the traditional primary targets of obesity interventions. However, long-term treatment success of weight-loss interventions is poor and these may need to consider tailored treatment elements for a sub-group of obese children including those exhibiting addiction-like eating (Ho et al., 2013). The role of addictive

behaviors in childhood obesity has been narratively explored (Yardley, Smith, Mingione, & Merlo, 2014). Investigating the construct of food addiction in childhood is warranted, given the associations with increasing prevalence of food addiction with increasing BMI that is observed in adults.

The scarcity of research in pediatric population groups is partly due to the limited methods available to detect indicators of food addiction or that tools require further refinements to enable them to be applied to pediatric groups. Although studies in children are somewhat preliminary, they suggest that addiction-like eating is associated with higher body mass in children and that a substantial proportion of obese adolescents seeking weight-loss treatment report addiction like eating.

Future directions

It is paramount that food addiction be explored in children, given food habits and behaviors that are formed in childhood track to adulthood (Birch & Fisher, 1998). If foods do have addictive potential, children may be impacted to a greater extent than adults due to psychological and neurobiological vulnerabilities at younger developmental stages.

It is well recognized in the field of dietary assessment that evaluating outcome variables that rely on self-report in children pose unique challenges. These issues, which must be overcome, relate to cognitive development and capacity to concentrate which both may influence children's ability to recall their behaviors (Collins, Watson, & Burrows, 2010; Livingstone, Robson, & Wallace, 2004).

In the preliminary YFAS-C validation study, a wide range of ages was included and parents were used to assist children only where needed and not wholly proxy report the survey, even in younger children. Future work on contextualizing the YFAS to be suitable for pediatric populations may need to apply learnings from the dietary domain whereby validation studies using objective biomarkers demonstrate that children less than 8 years cannot cognitively comprehend dietary surveys such as food frequency questionnaires (which could be likened to the YFAS). Instead, it is recommended to be completed by adults or primary care givers and those children greater than 8 years can self-complete and have been shown to more accurately report food intake and behaviors than their parents. This is interesting because mothers are most commonly used for proxy reports in children in both clinical and research settings. In recent dietary studies, mothers were found to be least accurate compared to the child and father (Burrows et al., 2013). However, uncertainty exists when a child is between the ages of eight and 12 years as to who (i.e. parent or child) should be asked to report child intake, due to factors including increasing child independence, cognitive abilities and increased consumption of food and drinks outside the home, that is, outside of parental control. Future studies including the YFAS in children should consider who is to report to best capture accurate information.

Future work needs to be conducted in this area to firstly come to an accepted definition of ‘food addiction’, which could be applied to both adult and pediatric populations. This issue is likely going to need an international consensus. Addictive-like eating differs from other addictions such as drug and alcohol dependence as every mammal eats from birth but only potentially encounters alcohol or human-manufactured psychoactive drugs much later in life. Thus, it appears to be particularly necessary for food addiction research to be extended to early years of age, where learning processes with regard to food and eating take place that are already established in adults.

This may also necessitate comparative studies using animal models. Not only does this research bear on evolutionary and neurobiological underpinnings of addiction (Avena, Rada, & Hoebel,

2008), it also allows for examining the developmental psychobiology of addiction. For instance, some animal research on adolescence and substance abuse (Doremus-Fitzwater, Varlinskaya, & Spear, 2010) addresses developmental changes in a way that research with humans never will for practical and ethical reasons. Thus, similar research approaches may be fruitful in the field of food addiction. Animal models may also facilitate understanding the role of *in utero* experiences in “food addiction”. While it is known that prenatal nutrition and exposure to maternal obesity influence the risk for obesity and metabolic dysregulations in offspring (e.g., Borengasser et al., 2014), examining and comparing the role in abuse liability of *in utero* exposure to psychoactive drugs versus dietary constituents might present an important paradigm.

In human adults, there is only one study (Curtis & Davis, 2014) and no study in children or adolescents that examined food addiction in the light of the new substance use disorder criteria in DSM-5 (American Psychiatric Association, 2013) and it remains to be discussed if and how these criteria may be applied to eating behavior (Meule & Gearhardt, 2014b). Diagnostic assessment tools such as the YFAS need to be further tested and evaluated with objective markers to eliminate the bias associated with self-report measures. This would demonstrate that the self-reported food addiction symptoms based on the YFAS can be observed in daily life and, thus, are indeed real in ‘food addicted’ individuals. Such measures could include detailed neuroimaging studies, which document brain changes in response to palatable, high-calorie foods. These neuronal changes could then be compared to patterns seen in individuals with substance use disorders. Ecological momentary assessment or longitudinal studies beginning in childhood could investigate changes that are usually seen in addiction, for example a dissociation of “wanting” and “liking” (Finlayson & Dalton, 2012). Directly studying addiction-like eating in children will contribute to a greater understanding of the validity and relevance of the food addiction concept and may potentially inspire new approaches for treatment and prevention of childhood obesity.

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