

# Future Directions in “Food Addiction”: Next Steps and Treatment Implications

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## Abstract

*Purpose of Review* The purposes of this study were to examine future directions regarding food addiction and to discuss potential treatment implications.

*Recent Findings* Foods likely differ in their ability to trigger addictive-like eating, with highly processed foods being the most closely associated with addictive processes. Harm reduction approaches may be relevant to the treatment of addictive-like eating. Food addiction is more closely associated with wanting for food, rather than liking the taste of food. Exposure to food cues increases wanting for food and increasing strategies to cope with cravings may be an important treatment approach. Negative affect likely increases vulnerability to overeating. Increasing emotion regulation capabilities may be important in reducing signs of food addiction.

*Summary* The role of addictive mechanisms in problematic eating requires additional research, but an addiction perspective may also have important treatment implications.

**Keywords** Food addiction · Obesity · Cue reactivity · Craving · Negative affect

## Introduction

Obesity is global pandemic. Although there have been some gains in reducing the rates of obesity, such as in children from

low-income households in the USA [1], global rates of obesity around the world continue to rise [2]. Further, weight loss attempts have limited long-term success [3, 4]. Many factors contribute to obesity risk (e.g., physical inactivity, genetic risk), but one contributor to the difficulty of achieving and maintaining a healthy body weight is the potentially addictive nature of highly processed foods (i.e., foods with added refined carbohydrates and/or fat). Rising obesity rates are associated with environmental changes where highly processed foods become cheap, convenient, and easily accessible [2]. However, not all individuals appear to be equally vulnerable to the impact of these highly rewarding foods. In the current manuscript, we will review the emerging research about how foods may vary in their ability to trigger addictive responses. We will also discuss factors that may increase an individual's vulnerability to the development of addictive-like eating, specifically cue-triggered wanting and negative affect. Further, we will review the potential treatment implications of these perspectives.

## The Contribution of the Food

Applying a substance use disorder framework to food would posit that certain foods exhibit an addictive potential, which interacts with a person's proneness for addiction and may result in a phenotype consistent with food addiction [5–7]. Previous research has demonstrated parallels in the characteristics shared among individuals endorsing addictive-like eating behavior on the Yale Food Addiction Scale (YFAS) [8, 9] and persons with substance use disorders, such as greater impulsivity, reward dysfunction, and emotion dysregulation [10–15]. Additionally, evidence examining which foods may have an addictive potential, akin to drugs of abuse, is growing, providing support for the idea that the attributes of the food contribute importantly to the development of addictive-like

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eating behavior. Previous research in animals and humans suggest that highly processed foods, with added amounts of fat and/or refined carbohydrates, (e.g., pizza, chocolate, cake, chips) are most closely associated with indicators of food addiction [16–20•].

Preliminary evidence for the food addiction framework was observed in animal models, demonstrating that rats experience addictive-like biological and behavioral responses to highly processed foods or ingredients added to highly processed foods (e.g., sugar). Bingeing on highly processed foods appears to alter reward-related neural functioning in a similar manner as repeated consumption of addictive drugs, such as downregulating dopamine receptors [16, 19]. Further, binge-prone rats with intermittent access to highly processed foods (e.g., Oreo cookie, cheesecake) demonstrate behavioral features of addiction, such as binge consumption, cue-induced motivation, increased consumption over time, and desire to seek out highly processed food despite negative consequences (e.g., foot shock) and having ample access to nutritionally balanced chow [16, 17, 19, 21]. Further, when sugar is removed from a rat's diet following prolonged, intermittent access, characteristic withdrawal symptoms are observed (e.g., teeth chattering, anxiety) [22]. Importantly, these biological and behavioral indicators of addiction do not occur in response to rats' nutritionally balanced chow [16, 17, 19], suggesting that highly processed foods play an important role in triggering addictive-like eating behavior. It may be that highly processed foods are similarly reinforcing as drugs of abuse, as one study found that rats were more likely to choose access to sugar than heroin or cocaine [23].

In humans, the YFAS operationalizes indicators of food addiction by applying the Diagnostic and Statistical Manual of Mental Disorder (DSM) diagnostic criteria for substance use disorders to consumption of certain foods [8]. Examples of YFAS food addiction symptoms include consumption in greater quantities than intended, use despite negative consequences, interference with social and professional role obligations, and withdrawal [8]. There have been few studies to date investigating which foods are most related to YFAS indicators of addictive-like eating behavior in humans, and this warrants future research attention. However, preliminary findings parallel animal models to suggest that not all foods are equally likely to be consumed in an addictive way, and highly processed foods appear to be most problematic.

A recent study instructed participants to first complete the YFAS then report how likely they are to experience problems, as described by the YFAS, with 34 foods that varied across nutritional characteristics (e.g., processing, fat, sugar) [20•]. Highly processed foods (e.g., chocolate, pizza, ice cream) were reported to be most associated with YFAS indicators of addictive-like eating, particularly for individuals who endorsed experiencing elevated YFAS food addiction symptomology [20•]. Further, a food's glycemic load, a

measure of how rapidly refined carbohydrates are absorbed by the bloodstream, was positively correlated with greater reports of addictive-like eating, especially for persons exhibiting greater YFAS food addiction symptoms [20•]. Notably, foods without added fats or refined carbohydrates (e.g., nuts, fruits, vegetables) were minimally related to YFAS indicators of food addiction [20•]. These findings suggest that the reinforcing nature of highly processed foods may be enhanced by the added, elevated amount of rewarding ingredients (added fats and/or refined carbohydrates), which may be rapidly absorbed by the body (e.g., high glycemic load). Notably, a concentrated “dose” and rapid absorption of an addictive agent are features that also increase the addictive potential for a drug of abuse (e.g., a 1.5 oz shot of hard liquor has a greater addictive potential than a 12 oz glass of beer) [24–26], suggesting that highly processed foods may be pharmacokinetically similar to drugs of abuse.

One other study provides further evidence for the close association between highly processed foods and addictive-like eating behavior, observing that individuals exhibiting YFAS indicators of food addiction reported more frequent consumption of highly processed foods, relative to those without addictive-like eating behavior [18]. Additionally, previous research has demonstrated that highly processed foods are more likely than foods without added fats or refined carbohydrates to be associated with addictive-like responses, such as binge consumption [27–29], loss of control over consumption, [29–31], craving [32–36], and consumption in greater quantities in response to negative affect [37–40].

In summary, previous research in animals and humans have demonstrated that all foods are not equally associated with addictive-like eating, and highly processed foods (e.g., pizza, chocolate, chips) appear to be most closely related to the food addiction phenotype. Thus, existing data supports using a substance use disorder framework to conceptualize food addiction, as it appears that the type of food (highly processed foods) importantly contributes to the development of addictive-like eating. It may be that highly processed foods are particularly reinforcing because they share features with drugs of abuse, such as an elevated “dose” of rewarding ingredients (e.g., fat, refined carbohydrates) that may be rapidly absorbed by the body (high glycemic load). Given that previous human studies examining the addictive nature of certain foods have been limited to self-report, future research is necessary to examine whether highly processed foods are capable of altering reward-related neural systems and driving forward compulsive consumption in a similar manner as drugs of abuse.

### Treatment Implications

If evidence for food addiction continues to grow, then the effectiveness of interventions for substance use disorders

may warrant empirical investigation for individuals experiencing addictive-like eating. Notably, existing treatment approaches like cognitive-behavioral therapy (CBT) for binge-type eating disorders already include components of addiction interventions, such as craving management and strategies for emotion regulation [41]. Thus, these skills may also be applied to clinical treatments of food addiction. However, there are distinct theoretical differences between eating disorders and substance use disorders that may inform novel interventions [42]. For instance, eating disorder treatments use the narrative that there are “no good or bad foods” and focus on helping individuals change their cognitions and behavior around triggering foods [43, 44]. In contrast, a substance-based food addiction perspective would acknowledge that certain foods (e.g., highly processed foods) directly contribute to addictive-like eating and should be addressed in treatment.

One possible addiction treatment approach that could be adapted to addictive-like eating is harm reduction. This intervention helps individuals assess their personal risk associated with substances and environmental contexts, in order to reduce the likelihood of problematic consumption [45]. Rather than promoting abstinence, a harm reduction approach helps clients identify situations that may be safe to use the substance or too risky and should be avoided. For example, an individual with alcohol-use disorder may recognize that they can have one glass of wine while at dinner with friends without experiencing problems but should not consume hard liquor while alone. This may translate to the treatment of food addiction by helping individuals determine the risk of consuming certain foods in various contexts. For instance, a person may realize that they are most prone to addictive-like eating with highly processed foods, particularly in the evenings or when alone, though have minimal problems consuming highly processed foods at special events (e.g., cake at a birthday party). Thus, harm reduction treatment for food addiction would focus on reducing exposure to high-risk situations and equipping the patient with skills (e.g., craving management) to reduce the likelihood of addictive-like eating, while not requiring individuals to remain abstinent.

### Incentive-Sensitization and the Role of Cues

Though the properties of certain foods likely cause them to have a greater addictive potential, not all individuals experience problematic consumption of these foods. The incentive-sensitization theory of addiction may explain why certain individuals are more prone to developing an addictive response to these foods [46, 47]. This theory describes two driving forces behind eating and other consummatory behavior. “Liking,” refers the hedonic pleasure derived from a substance, and may manifest as enjoyment of the taste and experience of eating a certain food [48]. “Wanting” refers to the intense desire and motivation to consume a substance and may manifest as craving for a certain food or exerting

effort to obtain a certain food [49]. “Wanting” in particular is theorized to be triggered by related cues in the environment, for example, the smell of freshly baked cookies, advertisements for palatable foods, or walking into a fast food restaurant [47]. After repeated exposure to certain foods, related cues begin to take on extra incentive salience, meaning the individual becomes particularly attuned to them and likely to focus on them over other stimuli [46]. This sensitization results in increased wanting and reward-seeking behavior in response to cues [50, 51]. Though a substance such as food is often both liked and wanted at the beginning, as sensitization occurs, wanting becomes stronger, while liking remains at the same level or even decreases [47, 52]. Thus, in individuals displaying an addictive response to a substance such as food, wanting is thought to be the driving force underlying problematic consumption [46].

Recent research testing aspects of the incentive-sensitization theory as applied to eating behavior provides support for the greater role of wanting relative to liking in contributing to overconsumption. Craving of highly processed foods is associated with more food addiction symptoms according to the YFAS, while liking of these foods is not [53, 54]. Wanting and liking also appear to be differentially affected by an environment rich in food cues. In a simulated fast food restaurant laboratory, individuals experience greater hunger and craving for highly processed foods (e.g., cheeseburger, French fries) and consume more calories than do individuals in a neutral environment [55]. However, individuals across these two contexts do not differ in their report of liking for the foods [55]. Thus, the presence of cues appears to impact wanting, but not liking, and elevated wanting appears to be associated with greater consumption. Additionally, cues may have the ability to impact perception of hunger in the absence of homeostatic need [56, 57]. Given that cue-triggered wanting is often implicit [52], it may manifest as a feeling of hunger, triggering overconsumption when in a state of satiety. The above research suggests that cues are a powerful driving influence on overeating, particularly in those susceptible to an addictive response to highly processed foods.

### Treatment Implications

Cues for unhealthy food are ubiquitous in the Western food environment, thus identifying and responding to cues may be an effective target for interventions aimed at reducing overeating and obesity. Interventions focused on identifying triggers and developing coping strategies to respond to them are used effectively in treatment of substance use disorders [58]. For patients experiencing symptoms of food addiction, strengthening awareness of the food cues they encounter daily and their response to them may be an important component of effective treatment. In fact, training people to inhibit a response to food cues is shown to decrease subsequent consumption [59]. Additionally, given the substantial role of

cue-triggered wanting, developing strategies to manage cravings may reduce the tendency to consume excessively in circumstances when people are faced with food-relevant cues. For example, the mindfulness-based approach of “urge surfing,” which teaches to ride out their cravings without giving in to them, has shown effectiveness in treating problem substance use as well as reducing consumption of chocolate [60–62]. As liking appears to hold less influence over problem eating behavior, targeting the pleasure derived from food is unlikely to be an effective treatment approach. Rather than attempting to reduce the pleasure and enjoyment derived from food, successful interventions may provide education on the effect of cues and skills to identify and cope with the cravings one may experience in their presence.

### The Role of Negative Affect

In studies of traditional substance use disorder, strong emotions are a common antecedent to the consumption of addictive substances. Specifically, substance abusers reference the alleviation of negative affect, or relief from negative emotions, as a major motivating factor in the consumption of drugs and alcohol [63, 64]. Furthermore, many substance abusers attempting to reduce or eliminate their substance use cite negative affect as a primary factor leading to relapse [65–67]. As such, several theories of addiction posit negative affect as an influential antecedent to substance use. For example, the affect regulation model of substance abuse hypothesizes that, over time, substance users learn that the consumption of addictive substances leads to reduced negative affect. As such, negative affect becomes a trigger for substance use. Thus, the relationship between negative affect and substance use becomes cyclical in that substance use is triggered by but also serves to alleviate negative affect, a process which is then sustained by negative reinforcement [68, 69, 70].

Negative affect has also been gaining attention in the growing field of food addiction research. As with traditional substance use, when self-report measures are utilized to collect data on binge eating episodes and other forms of maladaptive eating, negative affect is consistently associated with overconsumption [68, 71]. Similarly, when examining lapses in dieting behavior and weight loss programs, individuals cite negative affect as a common precipitating factor to diet violations [72]. Based on these self-report studies of maladaptive eating and weight loss, theories speculating the role of negative affect in food addiction have been developed that parallel the theories specifying the role of negative affect in traditional substance use disorders.

Although not specifically developed to explain the role of negative affect in food addiction, upwards of a dozen theories have been generated to explain the role of negative affect in the overconsumption of highly palatable foods. Of these theories, the most popular include the *affective regulation model*

which posits that negative affect triggers binge eating which in turn ameliorates negative affect [68, 73], the *theory of emotional eating* which views overeating as a coping strategy in response to emotional distress [74], and *emotional arousal theory* which postulates that overconsumption is induced in order to downregulate high levels of emotional arousal [75]. Despite differences in the origin of negative affect and how exactly negative affect triggers overconsumption, all affective theories of overconsumption and maladaptive eating behaviors maintain that negative affect is an important precipitant for binge eating behavior, and either during the act of overconsumption or following overconsumption, these negative emotions are diminished [76].

However, these theories have come into question due to their reliance on evidence derived from retrospective recall. That is, the self-report procedures used to build the above theories ask participants to remember binge episodes and instances of overconsumption from the past to determine which emotions were most often experienced before maladaptive eating behaviors [68, 71, 77]. Mounting evidence indicates that retrospective recall is systematically biased by a variety of factors [71, 78]. Most importantly, research suggests that the emotions an individual experiences while recalling past events can influence how the individual remembers the original event [67, 71, 78]. In regard to food addiction, this is problematic because data about emotions occurring before binge eating is often collected following the binge episode. Thus, the largely negative emotions an individual experiences in response to having binged or in response to breaking their diet may influence how the individual remembers the emotions they experienced prior to eating.

Fortunately, advances in portable technology now allow researchers to examine eating behavior in real time by asking participants to report on their affect immediately before food consumption [79]. Many real-time eating studies provide support in favor of influential role of negative affect. Heron, et al. [80] found evidence of increased negative affect immediately preceding loss-of-control eating, and Elliston, et al. [79] discovered that, when making eating decisions, negative affect was the highest during the decision to eat a high-calorie snack and the lowest during the decision to eat a low-calorie snack. Interestingly, additional studies have demonstrated that in addition to negative affect, increased positive affect may serve as a trigger for dietary relapse [72].

However, while research using real-time self-report technology suggests that negative affect is higher preceding binge-like eating behavior potentially supporting the affect regulation model of consumption, additional studies have demonstrated that negative affect remains high following binge-like eating episodes [81]. Such findings suggest that while an individual may be motivated to consume food in a binge-like manner in order to alleviate negative affect, eating in such a way can actually result in even greater negative affect

following a binge-like eating episode and is an ineffective emotion regulation strategy.

### Treatment Implications

Based on the preliminary, albeit mixed, evidence supporting the role of negative affect in maladaptive eating behavior, it may be important to consider emotional regulation techniques in the treatment of food addiction. Emotion regulation can be characterized as any attempt to moderate which emotions are experienced, how they are experienced, and how they can be reacted to [76]. Thus, when an individual with food addiction experiences negative affect, they can learn to self-regulate their emotional state with adaptive psychological techniques rather than relying on food to blunt their affect.

Similarly, because some theories posit the use of overconsumption as a coping mechanism to alleviate negative affect, it may also be important to incorporate adaptive coping techniques into the treatment of food addiction. Research shows that coping mechanisms such as distraction, problem-solving, and reappraisal are effective in preventing relapse and substance use in traditional addictive disorders [72, 82, 83]. Future research should examine the impact of adaptive coping strategies in food addiction in order to determine how best to treat individuals with food addiction symptoms and other disorders characterized by excessive food consumption.

### Conclusions

Scientific inquiry into the role of addictive processes in overeating is growing. Future research is needed to more fully evaluate the validity of the “food addiction” construct; however, evidence is emerging that foods differ in their likelihood of being consumed in an addictive manner. In particular, highly processed foods (with added fats and/or refined carbohydrates) appear to be the most implicated in addictive-like eating [20]. Treatment approaches that acknowledge that foods vary in their contribution to addictive-like eating, combined with strategies to assist in reducing harm around consumption of these foods, may be an important future direction. Further, environmental cues appear to be potent triggers for food craving, and addictive-like eating is associated with increased food cravings [53, 54, 55]. Intervention approaches that aim to identify triggering food cues and improve the ability to successfully respond to food cravings are also likely important for reducing addictive-like eating behavior. Finally, although future research is needed, negative affect may increase the propensity to eat in an addictive-like manner [68, 71, 77]. Clinically, increasing the effectiveness of emotion regulation strategies is a promising avenue.

### Compliance with Ethical Standards

**Conflict of Interest** Ms. Erica M. Schulte, Ms. Michelle A. Joyner, Miss Emma T. Schiestl, and Dr. Ashley N. Gearhardt declare that they have no conflicts of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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