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A commentary on the "eating addiction" versus "food addiction" perspectives on addictive-like food consumption

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ABSTRACT

The food addiction construct posits that vulnerable individuals may experience an addictive-like response to certain foods, such as those high in fat and refined carbohydrates. Recently, an alternative model to food addiction was proposed, suggesting that the act of eating may be a behavioral addiction that can trigger an addictive-like response in susceptible individuals. One major rationale for the eating addiction framework is that the assessment of food addiction is based on behavioral indicators, such as consuming greater quantities of food than intended and eating certain foods despite negative consequences. It is also suggested that the lack of investigation into which foods and food attributes (e.g., sugar) may have an addictive potential is evidence that food addiction does not parallel a substance-based addiction and more closely resembles a behavioral addiction. The present paper provides a commentary suggesting that the substance-based, food-addiction framework is more appropriate than the behavioral-addiction, eating-addiction perspective to conceptualize addictive-like food consumption. In order to illustrate this point, this manuscript will discuss behavioral components characteristic of all substance-use disorders, preliminary evidence to suggest that all foods are not equally associated with addictive-like eating, and key differences between the hypothesized eating addiction phenotype and the only existing behavioral addiction in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), gambling disorder. Further, this paper will consider implications of applying an addiction label to food versus eating and suggest future research directions to evaluate whether food addiction is a valid and clinically useful construct.

1. Introduction

In a recent paper, Hebebrand et al. (2014) propose that food addiction may be more appropriately categorized as a behavioral addiction, or an eating addiction, rather than a substance addiction. While food addiction and eating addiction appear related, the labels reflect distinct concepts, with varying perspectives on the mechanisms underlying addictive-like eating behavior. According to Google Scholar, Hebebrand et al.'s (2014) manuscript has been cited 75 times to date and has helped to generate a debate on whether addictive-like eating may reflect a behavioral or substance-based addiction (Albayrak & Hebebrand, 2015; De Jong, Vanderschuren & Adan, 2016; Pressman, Clemens, & Rodriguez, 2015), which highlights the need for evaluation of the eating addiction hypothesis. The current paper will offer a commentary that suggests that the substance-based, food-addiction construct more appropriately conceptualizes addictive-like food consumption than the behavioral-addiction, eating-addiction hypothesis. Yet, Hebebrand et al.'s (2014) eating-addiction perspective raises important points for consideration and future research. This manuscript will discuss evidence for the addictive potential of certain foods, examine the role of behaviors in all addictive disorders, evaluate the plausibility of eating as a behavioral addiction,

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and suggest future directions for research.

2. The addictive potentials of food are not equal

The term food addiction reflects a substance-based theoretical framework of addiction, where the food contributes importantly in eliciting addictive-like behavioral responses in susceptible individuals (Ahmed, Avena, Berridge, Gearhardt, & Guillem, 2013, pp. 2833–2857; Davis & Carter, 2009; Davis et al., 2011; Gearhardt, Corbin, & Brownell, 2009; Gearhardt, Davis, Kuschner, & Brownell, 2011; Gold, Frost-Pineda, & Jacobs, 2003; Schulte, Avena, & Gearhardt, 2015). In contrast, an eating addiction perspective suggests that the behavioral act of eating may become addictive to some individuals, and the attributes of the food (e.g., added sugar) do not directly trigger an addictive-like eating phenotype (Hebebrand et al., 2014). While both views agree that addictive-like eating behavior is possible, an important difference exists regarding the role of food. Thus, it is important to examine existing evidence to investigate whether certain foods or food characteristics may contribute to the development and maintenance of addictive-like responses, akin to drugs of abuse.

Though the term "food addiction" does not differentiate which foods may be associated with addictive-like eating, the construct posits that certain foods with added fat and/or refined carbohydrates like white flour or sugar (e.g., pizza, chocolate, chips) may uniquely activate the reward system in a manner similar to drugs of abuse, which may trigger problematic eating behavior in susceptible individuals (Gearhardt et al., 2009; Gearhardt, Davis, et al., 2011; Schulte et al., 2015). In support of this idea, animal models have revealed key biological and behavioral parallels between the consumption of high-fat, high-sugar foods and traditional addictive disorders. For example, bingeing on these foods (e.g., cheesecake) leads to changes in the reward system present in other addictive disorders, like the downregulation of dopamine receptors (Johnson & Kenny, 2010; Robinson et al., 2015). Binge-prone rats also demonstrate behavioral indicators of addiction to foods high in added fat and/or refined carbohydrates (e.g., sugar), such as binge consumption, use despite negative consequences, and cross-sensitization (Avena & Hoebel, 2003; Avena, Rada, & Hoebel, 2008; Johnson & Kenny, 2010; Oswald, Murdaugh, King, & Boggiano, 2011; Robinson et al., 2015). For example, binge-prone rats are uniquely motivated to seek high-fat, high-sugar foods despite negative consequences such as foot shock, and do not demonstrate this behavior towards nutritionally balanced chow (Oswald et al., 2011). Animal studies have also observed that rats exhibit symptoms of withdrawal (e.g., teeth chattering, anxiety) when sugar is removed from their diet after a period of intermittent bingeing and fasting (Avena, Bocarsly, Rada, Kim, & Hoebel, 2008), which is a behavioral circumstance that may increase the likelihood of compulsive-eating behavior (Berridge, 1996; Corwin, 2006).

While high-fat, high-sugar foods appear to be most implicated in addictive-like eating, some research has demonstrated circumstances that may trigger overeating of nutritionally balanced chow. For example, though rats will not binge eat chow if presented alone, they will overeat the chow after receiving a taste of a high-fat, high-sugar food (Hagan, Chandler, Wauford, Rybak, & Oswald, 2003), which highlights the possible need for exposure to high-fat, high-sugar foods to promote compulsive food consumption. Additionally, rats overconsume chow in environments containing cues paired with previous receipt of high-fat, high-sugar foods (Boggiano, Dorsey, Thomas, & Murdaugh, 2009). This suggests that high-fat, high-sugar food cues may trigger problematic eating behavior (e.g., overeating) in a manner similar to drug cues inducing relapse (Boggiano et al., 2009). While several studies have observed rats overeating chow, this behavior appears to occur only when primed first with receipt of a high-fat, high-sugar food or exposure to cues that were previously paired with receipt of high-fat, high-sugar foods. Thus, these findings suggest an important role for high-fat, high-sugar foods in triggering compulsive eating behavior.

Previous work examining humans provides support for the substance-based, food addiction framework, demonstrating that not all foods appear associated with addictive patterns of eating behaviors. Studies have found that foods with added fat and refined carbohydrates (e.g., pizza, chocolate, cake, cookies) were more likely to be consumed in an addictive, problematic manner (e.g., despite negative consequences, in greater quantities than intended) than less refined foods (e.g., nuts, fruit, lean meat) (Curtis & Davis, 2014; Schulte et al., 2015). Additionally, a recent study found that these high-fat, high-sugar foods were consumed more frequently among individuals who met criteria on the *Yale Food Addiction Scale* (YFAS, Gearhardt et al., 2009) for food addiction, relative to those who did not (Pursey, Collins, Stanwell, & Burrows, 2015).

Further, high-fat, high-sugar foods also appear to trigger behavioral responses that are consistent with addictive-like eating behavior and eating-related problems. High-fat, high-sugar foods are frequently consumed during binge episodes (Rosen, Leitenberg, Fisher, & Khazam, 1986; Vanderlinden, Dalle Grave, Vandereycken, & Noorduin, 2001; Yanovski et al., 1992) and may lead to poorly controlled eating (Arnow, Kenardy, & Agras; Vanderlinden et al., 2001; Waters, Hill, & Waller, 2001). Foods with added fat and refined carbohydrates, relative to fruits and vegetables, are more likely to be intensely craved (Gilhooly et al., 2007; Ifland et al., 2009; Weingarten & Elston, 1991; White & Grilo, 2005; Yanovski, 2003) and consumed in greater quantities in response to negative affect (Epel, Lapidus, McEwen, & Brownell, 2001; Oliver & Wardle, 1999; Oliver, Wardle, & Gibson, 2000; Zellner et al., 2006).

However, there appear to be specific contexts that may lead to overeating of both high-fat, high-sugar foods and foods low in fat and refined carbohydrates, such as severe food deprivation (Keys, Brožek, Henschel, Mickelsen, & Taylor, 1950). Additionally, studies of binge-type eating disorders (i.e., bulimia nervosa and binge eating disorder) have found that these individuals will also consume a variety of foods when given access to a buffet-style meal and instructed to binge (Goldfein, Walsh, LaChaussee, Kissileff, & Devlin, 1993; Guss, Kissileff, Devlin, Zimmerli, & Walsh, 2002; Hadigan, Kissileff, & Walsh, 1989; Walsh, Kissileff, Cassidy, & Dantzic, 1989; Yanovski et al., 1992). Thus, in extreme environments (e.g., food deprivation) and under certain laboratory circumstances (e.g., binge instruction), individuals may consume nutritionally diverse food items with binge-like consumption. Yet, within these studies, individuals exhibit more indicators of disordered eating with high-fat, high-sugar foods, relative to other foods (Hadigan et al., 1989; Yanovski et al., 1992), and report that their binge eating behavior would be intensified if they had access to specific high-fat, high-sugar foods (e.g., pizza, ice cream) (Yanovski et al., 1992). Additionally, these studies did not examine participants' eating behavior when given access only to foods low in fat and refined carbohydrates. Thus, existing evidence suggests that behavioral responses (e.g., diminished control) implicated in addictive disorders are most associated with high-fat, high-sugar foods in humans, though additional research is warranted to understand variability in food overconsumption under extreme circumstances (e.g., caloric deprivation, instructed bingeing).

In addition to behavioral parallels with drugs of abuse, human neuroimaging studies demonstrate that high-fat, high-sugar foods activate reward-related circuitry and may alter the reward system, akin to addictive substance (Smith & Robbins, 2013; Tryon et al., 2015; Volkow & Wise, 2005; Volkow, Wang, Fowler, & Telang, 2008; Volkow, Wang, Fowler, Tomasi, & Baler, 2012; Wang,

Volkow, Thanos, & Fowler, 2004). Further, individuals reporting features of food addiction as operationalized by the YFAS demonstrate dysfunctional patterns of reward-related neural activation when anticipating and consuming a high-fat, high-sugar food reward that are also observed in individuals with substance-use disorders, relative to drug-specific rewards (Gearhardt, Yokum, et al., 2011).

Collectively, existing evidence supports the idea that not all foods are equally associated with addictive patterns of eating behaviors or mechanisms implicated in addictive disorders (e.g., reward dysfunction). High-fat, high-sugar foods not only appear to be implicated in eating-related problems, but also may directly trigger behavioral responses (e.g., poor control) in a similar manner as drugs of abuse. Thus, current data support a food addiction model that highlights an important role for specific foods, and this contrasts with notions that the behavioral act of eating, independent of the type of food consumed, is the necessary precipitant for triggering an addictive process in susceptible individuals. In some respects, this might be akin to describing an individual with an intravenous heroin use condition as having a "shooting" or injection disorder rather than an opioid-use problem.

In summary, preliminary evidence supports a substance-based, food-addiction framework, where certain foods or food attributes (e.g., high-fat, high-sugar) may directly drive and maintain addictive-like patterns of consumption (Avena, Rada, et al., 2008; Gearhardt, Davis, et al., 2011; Johnson & Kenny, 2010; Robinson et al., 2015; Schulte et al., 2015). As such, Hebebrand et al.'s (2014) rejection of the food-addiction construct for a behavioral-addiction, eating-addiction framework does not logically follow from the existing data. Further, the authors' claim that food addiction is rare or nonexistent (Hebebrand et al., 2014) is inconsistent with a recent review suggesting that the prevalence of food addiction in community samples, as assessed by the YFAS, is 5–10% on average (Meule & Gearhardt, 2014), which is similar to prevalence rates of substance-use disorders (Grant et al., 2004) However, based on Hebebrand et al.'s (2014) critical comments regarding gaps in the food-addiction literature, we believe that the most appropriate next step is a systematic program of research to examine which food characteristics may exhibit an elevated addictive potential and for whom these foods may be most problematic.

3. The role of behaviors in addictive disorders

Hebebrand et al. (2014) state in multiple contexts that the correlates and assessment of addictive-like eating (e.g., questions on the YFAS) is reliant on behavioral features (e.g., poor control over food consumption), suggesting a behavioral addiction to the act of eating rather than a substance-like addiction to certain foods. In order to evaluate whether addictive-like eating is more consistent with a substance-based or behavioral addictions, it is important to examine how certain behaviors contribute to substance-use disorders and the differences between substance and behavioral addictions.

Substance-use disorders are a result of the interaction between an individual's propensity for addiction and a substance with an elevated addictive potential, meaning that the substance is highly reinforcing and has the ability to alter the reward system and perpetuate compulsive consumption (Everitt & Robbins, 2005; Koob & Le Moal, 2005; Volkow & Morales, 2015). While the substance contributes to the development of the addictive-like response, substance-use disorders are diagnosed by examining eleven behavioral indicators of an addiction, such as poor control over consumption and continued use despite negative consequences (American Psychiatric Association, 2013, pp. 481–590). These behavior-based symptoms are present across substance-use disorders, despite the varied effects of the substance on an individual. For example, consumption of alcohol is associated with high levels of intoxication relative to nicotine use, though individuals similarly experience behavioral features of addiction (e.g., limited ability or willingness to cut down or quit despite a desire to do so) in response to both substances. Presently, the assessment of substance-use disorders is reliant on evaluating these behavioral features, as there is no substance-based diagnostic method or biomarker of addiction. In parallel, the YFAS operationalizes addictive-like eating or consumption of food by examining the eleven behavioral indicators of substance-use disorders when the substance is primed as "certain foods", high in fat and/or refined carbohydrates.

In addition to assessing substance-use disorders with behavior-based criteria, certain behavioral patterns of use may exacerbate the addictive potential of the substance. Bingeing, intermittent access, and use in response to negative affect are behavioral components that enhance the addictive potential of a substance or process (Berridge, 1996; Hwa et al., 2011; Koob & Kreek, 2007; Robinson & Berridge, 2001; Sinha, 2001; Volkow & Morales, 2015). For example, binge drinking is a behavior that elevates the addictiveness of ethanol (alcohol) by increasing the concentrated dose of the substance in the body (Herz, 1997; Klatsky, Armstrong, & Kipp, 1990). Yet, the substance plays an integral role, as the behavior of binge drinking alone would not be reinforcing enough to exhibit an addictive potential with beverages like water. Thus, the characteristics of the addictive substance (e.g., alcohol) interact with behavioral patterns of engagement (e.g., bingeing) to result in a pattern of harmful or compulsive consumption. Notably, the behaviors (e.g., bingeing) alone are not sufficient to trigger an addictive-like response without the presence of a substance with addictive potential. In a similar vein, a substance-based, food-addiction framework would posit that addictive-like eating is an interaction of certain foods with addictive potential (e.g., high-fat, high-sugar foods), behavioral patterns of engagement (e.g., eating to cope with negative affect, intermittency), and individual risk factors for addiction (e.g., impulsivity) (Fig. 1).

In summary, all substance-use disorders are assessed using behavior-based criteria and behavioral patterns of engagement with substances may increase their addictive potential in individuals. In parallel, food addiction is also assessed by adapting the same behavioral indicators, and behavioral contexts are thought to

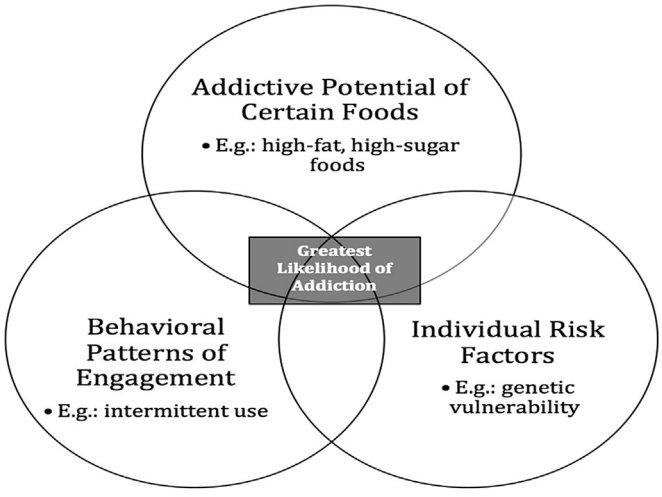

Fig. 1. Contributors to a food addiction phenotype.

be similarly important for elevating the likelihood that high-fat, high-sugar foods will be compulsively consumed. Thus, in order to elucidate whether addictive-like eating is more consistent with an addiction to certain foods or the act of eating, it is important to examine the distinct features of behavioral addictions (e.g., gambling disorder) that are not shared with substance-use disorders. A behavioral addiction consists of a behavior that is highly rewarding, reinforcing, and capable of altering the reward system in a similar manner as drugs of abuse to directly drive forward compulsive engagement in the behavior (Blaszczynski & Nower, 2002; Potenza, 2008). To date, gambling disorder is the only behavioral addiction in the main text of the DSM-5 (American Psychiatric Association, 2013). Akin to drugs of abuse, the process of gambling has characteristics that may increase the potential for compulsive engagement and alter the reward system in a manner that may lead to addictive-like responses in some individuals. Gambling may elevate the reinforcing nature of money by generating intermittent rewards, immediate feedback and rapid trials of winning and losing, and a triggering, cue-rich setting (Griffiths, 1999; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2004). While money is rewarding, it may have less addictive potential outside the context of gambling. As with substance-use disorders, the addictive nature of gambling may involve important behavioral patterns of engagement like intermittency (Alessi & Petry, 2003; Black & Moyer, 2014; Lesieur & Custer, 1984; Williams, Grisham, Erskine, & Cassedy, 2012).

Further, the assessment of gambling disorder uses similar behavioral indicators (e.g., poor control) as substance-use disorders (American Psychiatric Association, 2013). As the eleven core diagnostic criteria were adapted to account for variability of symptom presentation across substance-use disorders (e.g., no withdrawal for hallucinogens, emphasizing psychological nature of withdrawal for cannabis), data-informed considerations were involved in the development of the criteria for gambling disorder (Denis, Fatseas, & Auriacombe, 2012; Hasin et al., 2013; Lesieur & Rosenthal, 1991; Petry, Blanco, Stinchfield, & Volberg, 2013). For example, rather than needing to consume a greater quantity of a substance over time to achieve a desired effect, tolerance in gambling disorder is assessed by needing to gamble greater amounts of money to achieve a desired effect (American Psychiatric Association, 2013). Additionally, several of the substance-based criteria are not used to assess gambling disorder (e.g., use in physically hazardous situations), though criteria are included to capture unique clinical features of gambling disorder (e.g., chasing losses, relying on others to provide money to escape from a desperate gambling-related financial situation) (American Psychiatric Association, 2013). Thus, while the behavioral criteria for diagnosing substance-use disorders and gambling disorder are tailored based on symptom presentation, the underlying mechanisms (e.g., poor control, tolerance, repeated unsuccessful attempts to cut back or quit, and interference in major areas of life functioning) are shared across substance and behavioral addictive disorders.

Ultimately, behavioral addictions differ from substance-use disorders because there is no ingested substance. In contrast with gambling disorder, the existing behavioral addiction in the DSM-5, eating involves the ingestion of food, whereas gambling does not involve substance consumption. In order to consider eating a true behavioral addiction like gambling, the nature of the ingested food should have no impact on the development of the addictive process, which is not supported by existing evidence suggesting that high-fat, high-sugar foods appear to be most closely associated with addictive-like eating behavior (Avena, Bocarsly, et al., 2008; Avena, Rada, et al., 2008; Boggiano et al., 2007; Johnson & Kenny, 2010; Schulte et al., 2015). In support of this preliminary evidence, future research should investigate whether these foods are capable of altering reward-related neural circuitry in a manner that directly drives compulsive consumption, akin to drugs of abuse.

Another key difference between behavioral addictions like gambling disorder and addictive-like eating is that the act of eating, though pleasurable, does not intensely activate the reward system or override executive control functions as occurs during the process of gambling. Further, one of the comments levied against the food-addiction construct is that all individuals need to consume food to survive, so food cannot be addictive (Corwin & Grigson, 2009). Yet, the behavioral-addiction, eating-addiction perspective posits that susceptible individuals may develop an addiction to a behavior that sustains life (eating), triggered by consumption of any food. As discussed above, it appears that only certain foods (e.g., high-fat, high-sugar foods) that are typically not in their “natural state” (i.e., that are highly processed) are likely to be implicated in this addictive-like response (Gearhardt, Davis, et al., 2011; Ifland et al., 2009, 2015; Schulte et al., 2015). Thus, the existing evidence suggests that addictive-like eating is more comparable to a substance-based, food-addiction perspective than a behavioral-addiction, eating-addiction one, primarily due to the ingestion of a rewarding “substance”.

4. Implications of employing food-addiction versus eating-addiction frameworks

Hebebrand et al. (2014) suggest that a substance-based food-addiction framework offers individuals an excuse for problematic eating behavior and reflects a passive process that befalls an individual. The authors then argue that eating addiction is a more appropriate term because it emphasizes the behavioral component (Hebebrand et al., 2014). However, treatment of both substance-use disorders and behavioral addictions relies on behavioral strategies, with greater engagement (e.g., session attendance, homework completion, client commitment) associated with more positive treatment outcomes (Dowling & Cosic, 2011; Simpson, 2004; Simpson, Joe, Rowan-Szal, & Greener, 1995; Wolfe, Kay-Lambkin, Bowman, & Childs, 2013). Yet, Hebebrand et al.'s (2014) claim that an individual is a passive recipient of an addictive disorder may be considered a stigmatizing narrative of addiction that does not reflect the current state of the research or modern views of individuals with addictions (Corrigan, Kuwabara, & O'Shaughnessy, 2009; Hing, Russell, Gainsbury, & Nuske, 2015; Schomerus et al., 2011). Further, Horch and Hodgins (2008) observed no differences in stigma associated with gambling disorder relative to alcohol-use disorder. Thus, the suggestion that a substance-use disorder would be more passive and stigmatizing than a behavioral addiction is unsupported by theoretical perspectives and empirical evidence related to the course and treatment of all addictions (Alavi et al., 2012; Feldman & Crandall, 2007; Horch & Hodgins, 2008).

Importantly, several recent studies demonstrate that exposure to a substance-based food-addiction framework has neutral or positive implications on reducing stigma and no impact on food intake (Hardman et al., 2015; Latner, Puhl, Murakami, & O'Brien, 2014; Lee, Hall, Lucke, Forlini, & Carter, 2014). In contrast, the behavioral-addiction, eating-addiction framework ignores the contribution of the food attributes in the development and maintenance of an addictive-like response, which limits the opportunities for intervention. Thus, in addition to psychotherapy interventions, if high-fat, high-sugar foods exhibit an addictive potential for some individuals, one essential next step from a public health perspective may involve developing best practices within the food industry, such as reducing marketing of these foods to children (Harris, Pomeranz, Lobstein, & Brownell, 2009).

5. Summary

Though Hebebrand et al.'s (2014) paper provides a critical evaluation of food addiction, the proposed alternative of defining eating as a behavioral addiction appears problematic for several reasons. In order to conceptualize eating as a behavioral addiction, empirical studies would need to demonstrate that all foods have equal potential to be implicated in the addictive process. Yet, preliminary evidence in animal and human studies suggests a central role of high-fat, high-sugar foods in the development of eating-related problems and demonstrates that certain foods (e.g., nutritionally balanced chow) may even be unlikely to trigger overeating behaviors on their own.

Additionally, the proposed eating-addiction perspective erroneously highlights the presence of behavioral symptoms in addictive-like eating as evidence that eating is a behavioral addiction. However, all addictive disorders, including substance-use disorders and behavioral addictions, are associated with behavioral diagnostic approaches (e.g., observing use despite negative consequences), behavior-based interventions (e.g., homework completion), and behavioral aspects of engagement (e.g., intermittent use). A key difference between substance-use disorders and behavioral addictions is that no substance is ingested in a behavior-based addiction (e.g., gambling). Applied to addictive-like eating, a behavioral-addiction, eating-addiction framework would only be appropriate if research demonstrated that the type of food ingested had no relationship to the development of the addictive-like eating behavior. As certain foods (e.g., high-fat, high-sugar foods) appear more closely related to addictive-like eating, ignoring the role of these foods from an eating addiction perspective may limit opportunities for intervention and public policy initiatives.

Overall, the current state of the literature suggests that the substance-based food-addiction perspective, rather than eating as a behavioral addiction, most appropriately reflects the interaction between an individual's propensity for addiction, behavioral patterns of engagement that elevate addictive potential, and the possible role of high-fat, high-sugar foods to trigger and perpetuate the addictive-like phenotype. Next steps in this line of research should aim to refine the general term "food addiction" to specifically reflect which foods or ingredients may have an addictive potential.

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