Associations Between Food Addiction and Substance-Use Disorders: A Critical Overview of their Overlapping Patterns of Consumption

Revi Bonder1 • Caroline Davis1

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Abstract
Purpose of Review Research on patterns of overconsumption in individuals with food addiction (FA) has focused largely on binge eating. However, compulsive overeating can be varied and dimensional. This review focuses on the similarities between the patterns of consumption in FA and in other clinically established substance-use disorders, such as alcohol and nicotine dependence. It also highlights features that make FA unique to other addiction disorders.

Recent Findings Overall, there is substantial evidence that binge-like overconsumption is a characteristic of various substance-use and eating disorders. Likewise, it appears that different overeating patterns can reflect addictive-like eating. One pattern may be compulsive grazing — defined as the repetitive inability to resist consumption of small amounts of food.

Summary This review adds to the increasingly compelling picture that FA and binge-eating disorder are unique conditions, and that FA resembles other substance-use disorders. We conclude that a variety of overeating patterns can reflect addictive eating behaviours in vulnerable individuals, one of which may be compulsive grazing.

Keywords Food addiction · Binge eating · Grazing · Compulsive overeating · Substance-use disorders

Introduction

In an attempt to advance the nosology of food addiction (FA), one recent review identified two notable priorities for future FA research — the first was to establish diagnosable features unique to addictive-like eating [1••]. Accordingly, the purpose of this special issue is to contribute to the evidence that FA is a bona fide and unique condition that resembles other addiction disorders. Our objective in this larger context is to review the parallels between the patterns of consumption seen in conventional substance-use disorders and in FA — a discussion of which is missing in the literature [2, 3, 4••]. In general, research on patterns of overconsumption in individuals with compulsive overeating has focused largely on binge eating — an issue that will be addressed in more detail later in this review [5]. However, we know from clinical reports that patterns of excessive intake can be varied and dimensional [6, 7]. For example, subjective descriptions from individuals with obesity have included “binge eating,” “constant overeating,” “hyperphagia,” “stuffing syndrome,” “nibbling,” and “between-meal snacking” [5].

In the following sections of this paper, we focus on the similarities between the patterns of consumption in FA and in other clinically established substance-use disorders such as alcohol and nicotine dependence. We also outline differences in facets of FA that render it unique to other addictive conditions.

Background

A wealth of evidence has shown that weight loss is seldom sustained long term solely through the provision of lifestyle changes (i.e., diet and exercise) [8, 9]. Weight cycling commonly occurs in both women and men, and global obesity levels remain high [8, 9]. This has become particularly evident during the ongoing coronavirus (COVID-19) pandemic, where both obesity prevalence and food consumption have increased [10]. Indeed, there is also good evidence that...
Factors other than lack of motivation influence weight gain, and re-gain. One perspective is that dramatic changes in food type and availability poorly serve our inherent biological predisposition to consume high-calorie foods, even in the absence of hunger [11]. The outcome is an evolutionary “mismatch” that can promote chronic and excessive intake of food — especially in certain vulnerable individuals [11].

In recent years, attention has focused on the notion that ultra-processed foods, and those with a high-glycemic load, can lead to an addictive process akin to that seen in other substance-use disorders [12–14]. In other words, such foods can promote escalation of intake, withdrawal, pronounced cravings, and relapse — a syndrome which has come to be known colloquially as FA [12–14]. That is, some individuals may continuously attempt and express a desire to reduce their food intake, but repeatedly fail to do so despite emotional, social, or health consequences [15].

A salient point is that individual differences in affinity for “reward” contribute to vulnerability for addiction. Particularly, the confluence of various psychobiological and environmental risk factors can cause individuals to experience a heightened response to the rewarding properties of ultra-processed foods [16]. Further analysis of these risk factors is outside the scope of this review, but will be covered by other contributions in this special issue. Correspondingly, we cannot assume that all instances of overeating represent an addiction to food, in the same way that one would not expect all those who regularly consume alcohol to develop alcohol-use disorder. For example, while the majority of adults consume alcohol in their lifetime, only about 5–10% become dependent on it [17, 18]. Similarly, it is estimated that FA is prevalent in 8–15% of individuals in the general population [19, 20].

In the current review, we draw parallels from alcohol and nicotine dependence as we believe these are the most appropriate addiction disorders to compare with addictive-like food consumption. Like with food, the consumption of alcohol and tobacco is attainable legally — as opposed to other substances such as cocaine or heroin. Indeed, in the early twentieth century, smoking tobacco was viewed as a “natural accompaniment of work and play” [21]. In addition, all three substances have a long history and well-established association with wealth, celebration, and cultural/religious rituals [22]. Moreover, adverse effects from chronic alcohol and nicotine consumption, such as liver cirrhosis and lung cancer, only appear after years of consumption. Likewise, chronic overconsumption of food can lead to obesity, diabetes, or cardiovascular disease over time [4••].

### Binge-Like Consumption as a Cross-Diagnostic Behavior

The overlap between FA and binge-eating disorder (BED) is not surprising given that they share symptomology (e.g., repeatedly failing to mitigate compulsions and impulsiveness). The two disorders can also subsume other psychopathological maladies such as attention-deficit hyperactive disorder, depression, and anxiety [23–25]. Individuals with BED and FA also display similar neurobiological profiles, wherein they both exhibit elevated food-related reward responses [26]. For example, when consuming ultra-processed foods (e.g., a chocolate milkshake), women with FA showed less activation in the lateral orbitofrontal cortex — an area of the brain associated with inhibitory control [27]. Greater activation is associated with an increased ability to self-control excessive behaviours such as food or drug overconsumption [28].

Accordingly, a key characteristic of both conditions is a loss of control (LOC) over the intake of certain foods — typically those that are hyper-palatable and calorically dense [26, 29]. For example, if the difficulty to resist the hedonic urge to eat tasty foods is strong enough, individuals may feel a subjective inability to self-regulate what and how much is eaten [30, 31]. LOC eating may develop over time from constant exposure to ultra-processed foods [30, 31]. For example, it has been shown that LOC eating episodes typically appear in childhood, while clinically relevant symptoms of FA develop first in adolescence [32, 33].

However, while BED and FA are marked by overlapping symptoms, evidence suggests that individuals with FA experience greater compulsive eating, distress, impulsivity, and mood disorders when compared to those with BED [24, 26, 34]. One viewpoint is that among those with BED, FA may reflect a more severe condition, characterized by addictive-like behaviours [35, 36]. That is, for some, the development of binge-eating behaviours — viz. increased LOC, and frequency and size of binge episodes — may ultimately trigger a severely compulsive and pathological condition that has strong clinical and biological parallels to other clinically established addiction disorders [35, 36]. Accordingly, Davis’ dimensional view of overeating (see Fig. 1) proposes that food consumption patterns range from non-psychopathological homeostatic eating (energy-balance eating) at the lowest end of the continuum to FA at the highest. Binge-eating behaviors start mid-way along this continuum. In other words, untreated and/or chronic binge eating may develop into an addiction disorder in the same way that heavy alcohol consumption may lead to an alcohol-use disorder, or “chain

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1 Ultra-processed foods describe foods which are significantly altered from their original state to enhance their sensorial properties and make them hyper-palatable. Alternations may include the addition of salt, sugar, oils, fats, and other additives that are not naturally present, such as preservatives and/or artificial colors [81].
“Grazing” in Food Addiction

It is becoming evident that a LOC over food consumption can occur irrespective of the volume of food consumed [43]. Interestingly, research in treatment-seeking individuals with BED and obesity has found that resolving binge eating does not tend to produce significant weight loss (e.g., [44]). Instead, individuals report lingering patterns of uncontrolled, unstructured, and repetitive consumption of small amounts of food following treatment [5].

This pattern of overeating has been called compulsive grazing and is characterized by a repetitive inability to resist consumption of relatively small amounts of food over an extended period of time, outside of planned meals and irrespective of hunger or satiety sensations. There also exists a non-compulsive form, which others have referred to as “nibbling” or “snacking” — and describes a pattern of overeating that is repetitive in a distracted, rather than a compulsive, fashion [45••, 46••]. Importantly, non-compulsive grazing is sometimes viewed as an adaptive eating behavior [45••, 46••]. For example, Reas et al. [47] found that “nibbling” among university students was common, and not associated with increased BMI or other eating psychopathology. Similarly, studies looking specifically at non-compulsive grazing reported no relationship with weight gain, binge eating, or other eating psychopathology [48]. Therefore, non-compulsive grazing may be a healthy eating behavior used by weight-loss treatment-seeking individuals, in an attempt to restrict food intake [49••]. Alternatively, compulsive grazing — which includes a sense of LOC — has been associated with greater weight dysregulation, reduced body image and treatment success for obesity, increased levels of depression and anxiety, and more frequent and severe binge eating [50••]. For example, a treatment program for individuals with obesity that targeted inhibition found that treatment reduced grazing incidences, suggesting that grazing is associated with decreased self-regulation [51]. Importantly, compulsive grazing and binge eating are similar in that they are both associated with feelings of LOC over eating, yet grazing is unique in its lack of discrete time limits, the relatively slow manner in which eating occurs, and the relatively small amounts of food at each intake [45••, 46••].

Grazing has garnered the most clinical interest in the field of post-operative bariatric surgery, where it is viewed as a significant form of overeating associated with reduced treatment success. Indeed, it has frequently been described as a “high-risk behavior” [5, 52, 53]. Evidence suggests that the vast majority (~80%) of bariatric surgery patients experience post-operative grazing episodes — since it becomes physiologically impossible for them to consume large amounts of food at once [45••, 52, 54]. While it is suggested that bariatric surgery could be beneficial for those struggling with obesity, about a quarter of operated patients regain weight because of recurring disordered eating behaviours such as food compulsions, cravings, and “snacking” [54, 55]. It should be emphasized that grazing is different from the small meals prescribed to those who have had bariatric surgery [56]. In the latter situation, both the choice of food and the time of ingestion are intentionally planned and controlled to occur in response to hunger/satiety signals [52].
Despite being labelled a high-risk eating behavior, grazing remains vastly understudied within the FA population. A PubMed search of the terms “grazing” and “food addiction” produced 5 results — two articles of which we had written [6, 42••]. In the first, we investigated relationships between FA and other patterns of overeating, including compulsive grazing, in a general population sample [42••]. We found a positive relationship between FA and grazing. Interestingly, after accounting for compulsive grazing in the statistical model, binge eating added no further unique variance to the symptom severity of FA. We recently conducted a second study in a high-risk sample of weight-loss seeking individuals with overweight or obesity [57••]. In this sample, which had an FA prevalence of 28%, we similarly found that grazing was significant, but binge eating was not, in our model. Interestingly, grazing was the greatest contributor of variance in the dependent variable (FA). Together, these studies support the view that individuals with addictive tendencies towards food also display elevated levels of compulsive grazing. Others have also found that those with FA are more likely to report higher consumption of sweet and salty “snack foods” such as chips, pastries, and ice cream [6]. Therefore, it is probable that FA comprises various dietary patterns, including both binge eating and grazing.

Consumption Patterns in Traditional Substance-Use Disorders

Similar to food, consumption patterns in other addictive substances, such as nicotine and alcohol, can also vary. For example, Epstein et al. [58] identified four clinically relevant patterns of alcohol consumption in alcohol-dependent adults — binge, episodic, sporadic, and steady — and found that only 6.5% of individuals with alcohol-use disorder binge drink [58]. That is, while some individuals may engage in one binge-drinking episode per day, others may consume similar volumes of alcohol continuously throughout the day over several discrete drinking episodes [59]. As such, alcohol-use disorder may involve daily heavy drinking that does not fall under the definition of binge drinking [40].

Similarly, the portrait of a “high-functioning alcoholic” (HFA) suggests that some individuals with alcohol-use disorder can still maintain high-position jobs and stable relationships [60]. They often do not drink to the point of “blacking out” — in other words, they often do not binge drink [60]. Clinical reports of HFA college students show that they binge drink only on certain days of the week, for a certain number of days, or only after they have completed their responsibilities (e.g., assignments and/or studying) [60]. Others are daily drinkers who sustain a steady blood alcohol level [60]. Since binge drinking is so pervasive in college culture, clinicians report difficulties knowing when it is actually pathological [60]. Instead, some maintain it is the LOC and attempts to ameliorate negative feelings that better defines someone with an alcohol-use disorder [60]. That is, the overconsumption of alcohol in a binge-drinking pattern is not equivalent to having an addiction towards it.

Likewise, various patterns of intake have been identified in those with nicotine dependence. For example, one study identified five classes of cigarette smoking patterns: non-context, puffers, social, moderate, and heavy smokers [61]. The authors of this study suggested that such a classification may represent a transitional process from experimentation to nicotine dependence [61]. Similarly, while some with nicotine dependence are considered “chain smokers,” others show patterns of intermittent smoking, which involves consuming less than five cigarettes per day, and smoking less than daily [62]. However, even intermittent smokers may experience symptoms of withdrawal, craving, and relapse when they attempt to abstain [62]. Evidence suggests that three quarters of intermittent smokers relapse after attempting to quit [62, 63].

Comparably, a seminal study on nicotine dependence in youth showed that symptoms of dependence can develop irrespective of the volume or frequency of cigarettes smoked [64]. Participants reported a mean cigarette consumption of 2 per week at the onset of dependence symptoms [64, 65]. Some youth developed nicotine dependence after smoking only eight cigarettes a month, reporting difficulties quitting and withdrawal [64, 65]. As such, it has been suggested that different types of interventions may be needed for different types of smokers [61]. For instance, traditional cessation programs may not be successful with non-daily smokers, primarily because they do not perceive themselves as having a problem [61].

Differences in Consumption Among Those with Food Addiction Compared to Those with Traditional Substance-Use Disorders

Global prevalence of traditional substance-use disorders has remained relatively steady over the past two decades [66]. Alternatively, food portions, and the percent of daily calories from “fast foods” (e.g., hot dogs, hamburgers, French fries), have significantly increased [67]. Such foods are cheap, easily obtainable, heavily marketed, and legal [68]. Therefore, the likelihood of exposure to a food-related cue is high. This is particularly relevant since food-related cues have been shown to increase appetitive behavior (i.e., salivation, gastric acid secretion, insulin release), and desire to eat, even in the absence of hunger [7, 69]. Moreover, and as has also been seen with other addiction disorders, repeated exposure to such foods and their cues increases sensitization — meaning an individual
can become hyper-reactive to these cues, and therefore more likely to act on their compulsion to eat [70, 71]. Importantly, while it is common for traditional addiction rehabilitation programs to promote restraint from externally triggering stimuli (e.g., certain social settings, drug paraphernalia), it is considerably more difficult for those with FA to avoid food cues. Given that food and associated cues are ubiquitous in most developed countries, refraining from the compulsion to overeat may be more difficult for the affected individual than in the case of other addiction disorders [7, 72].

Other arguments against the validity of the FA construct are that unlike drugs, food is necessary for survival (e.g., [3]). While it is true that humans must eat to survive, several scholars have eloquently argued that it is only the ultra-processed, calorically dense foods that have addictive potential (see [73, 74]). In other words, a healthy, life-sustaining diet does not require the consumption of ultra-processed foods — or foods that have high levels of refined sugar or processed fats. It has been estimated that more than 50% of the calories in ultra-processed foods come from added sugars, and that some form of sugar has been added to about 75% of the food supply chain [75–77]. Likewise, the tobacco industry participates in nicotine “dosing,” to ensure that nicotine levels in cigarettes encourage overconsumption [77].

Lastly, while all addictions reflect a set of underlying symptoms and processes, they can manifest differently depending on the substance consumed [15]. This variability has been acknowledged in the current version of the Diagnostic and Statistical Manual (DSM-5) [78]. For instance, a diagnosis of substance dependence can be given if an individual meets any combination of two of the 11 symptoms presented [78]. This was reduced from three symptoms in the preceding version of the DSM, further highlighting the heterogeneous nature of these addictions [78]. Furthermore, while opioid withdrawal is a life-threatening condition where symptoms range from restlessness to seizures [79], nicotine withdrawal is characterized by irritability and anxiety and causes relatively little impairment in one’s daily life [78]. Still, one cannot refute that both substances trigger an addictive response and are difficult to abstain from when consumed regularly [68]. In other words, a substance can still be considered highly addictive without having acute life-threatening side effects, or severe withdrawal [68]. Correspondingly, withdrawal symptoms from FA include headaches, fatigue, irritability, anxiety, depressive moods, and restlessness [80]. However, the chronic overconsumption of caloric and ultra-processed foods may still play a role in premature death. Non-communicable conditions such as diabetes and cardiovascular disease — which are highly co-morbid with obesity — are the leading causes of mortality in the world [68, 74]. Therefore, and similar to nicotine dependence, the absence of severe and immediate withdrawal symptoms is not a sufficient reason to devalue the addictive potential of a substance.

Conclusions

We review the evidence that a variety of overeating patterns can reflect addictive eating behaviours in vulnerable individuals, similar to what is seen in other substance-use disorders. Given that BED and FA are frequently conflated in discussions of compulsive overeating, it is important to emphasize that binge eating is not essential for a diagnosis of FA. That is, while the transition from BED to FA clearly describes some overeating experiences, others exhibit a progression to food dependence that includes other LOC patterns such as compulsive grazing. Such heterogeneity is similar to conventional substance-use disorders like alcohol and nicotine dependence.

The study of eating patterns that contribute to, and are characteristic of, addictive tendencies towards food is particularly germane given that weight-loss programs focusing on energy balance remain largely ineffective, and since obesity relapse remains high. It is also important to understand addictive-like overeating in the context of both internalized and externalized (family/friends/society) stigmatization [see 34,73,74]. An acknowledgement that eating can become compulsive and addictive for some may help explain the lack of control experienced in those with obesity. This knowledge may reduce stigmatization from others and increase one’s willingness to seek treatment for their obesity.

Declarations

Conflict of Interest The authors declare no competing interests.

Human and Animal rights and Informed Consent All reported studies/experiments with human subjects performed by the authors have either been previously published or are in preparation to be published, and comply with all applicable ethical standards (including the Helsinki Declaration and its amendments, institutional/national research committee standards, and international/national/institutional guidelines).

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- •• Of major importance

1. •• Schulte EM, Wadden TA, Allison KC. An evaluation of food addiction as a distinct psychiatric disorder. Int J Eat Disord. 2020;53:1610–22. https://doi.org/10.1002/eat.23350. Literature
review on whether FA should be considered a unique disorder in the DSM. The review found that an FA diagnosis may have clinical utility.

2. Hebebrand J, Albyarayk O, Adan R, Antel J, Dieguez C, de Jong J, et al. “Eating addiction”, rather than “food addiction”, better captures addictive-like behavior eating. Neurosci Biobehav Rev. 2014;47:295–306. https://doi.org/10.1016/j.neubiorev.2014.08.016.

3. Ziauddine H, Fletcher PC. Is food addiction a valid and useful concept? Obes Rev. 2013;14:19–28. https://doi.org/10.1111/j.1467-789X.2012.01046.x.

4. Gearhardt AN, Hebebrand J. The concept of “food addiction” helps inform the understanding of overeating and obesity: YES. Am J Clin Nutr. 2021;113:263–7. https://doi.org/10.1093/ajcn/nqaa343. Part of an article series written in an Oxford-style debate. Authors debated pro and con positions on the validity of the FA concept. Readers are also directed to the second article in this two-article series.

5. Lane B, Szabó M. Uncontrolled, repetitive eating of small amounts of food or ‘Grazing’: development and evaluation of a new measure of atypical eating. Behav Chang. 2013;30:57–73. https://doi.org/10.1017/bec.2013.6.

6. Davis C. A commentary on the associations among ‘food addiction’, binge eating disorder, and obesity: overlapping conditions with idiosyncratic clinical features. Appetite. 2016:1–6. https://doi.org/10.1016/j.appet.2016.11.001.

7. Carter FA, Jansen A. Improving psychological treatment for obesity: which eating behaviours should we target? Appetite. 2012;58:1063–9. https://doi.org/10.1016/j.appet.2012.01.016.

8. Hankey C. Weight loss maintenance and weight cycling. Clin Obes Adults Child 2022: 306–13. https://doi.org/10.1002/19781119695257.CH23.

9. World Health Organization. Obesity and overweight. 2020. Retrieved from https://www.who.int/en/news-room/factsheets/detail/obesity-and-overweight.

10. Janssen M, Chang BPI, Hristov H, Pravst I, Profeta A, Millard J. Changes in food consumption during the COVID-19 pandemic: analysis of consumer survey data from the first lockdown period in Denmark, Germany, and Slovenia. Front Nutr. 2021.8:60. https://doi.org/10.3389/fnut.2021.635859.

11. Davis C. Evolutionary and neuropsychological perspectives on addictive behaviors and addictive substances: relevance to the “food addiction” construct. Subst Abuse Rehabil. 2014:5:129–37. https://doi.org/10.2147/SAR.S56835.

12. Contreras-Rodriguez O, Burrows T, Pursey KM, Stanwell P, Parkes L, Soriano-Mas C, et al. Food addiction linked to changes in ventral striatum functional connectivity between fasting and satiety. Appetite. 2019;133:18–23. https://doi.org/10.1016/j.appet.2018.10.009.

13. Kakoschke N, Aarts E, Verdejo-García A. The cognitive drivers of compulsive eating behavior. Front Behav Neurosci. 2019;12:1–8. https://doi.org/10.3389/fnbeh.2018.00338.

14. Volkow ND, Wise RA, Baler R. The dopamine motive system: implications for drug and food addiction. Nat. Rev. Neurosci 2017;74:51–2. https://doi.org/10.1038/nrn.2017.130.

15. Fletcher PC, Kenny PJ. Food addiction: a valid concept? Neuropsychopharmacology 2018;43:2506–13. https://doi.org/10.1038/s41386-018-0203-9.

16. Loxton NJ, Tipman RJ. Reward sensitivity and food addiction in women. Appetite. 2017;115:28–35. https://doi.org/10.1016/j.appet.2016.10.022.

17. Hasin DS, Stinson FS, Ogburn E, Grant BF. Prevalence, correlates, disability, and comorbidity of DSM-IV alcohol abuse and dependence in the United States: results from the National Epidemiologic Survey on alcohol and related conditions. Arch Gen Psychiatry. 2007;64(7):830–42. https://doi.org/10.1001/archpsyc.64.7.830.

18. National Institute on Alcohol Abuse and Alcoholism. Alcohol facts and statistics. 2021. Retrieved from https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/alcohol-facts-and-statistics.

19. Oliveria J, Colombaroll MS, Cordas TA. Prevalence and correlates of food addiction: systematic review of studies with the YFAS 2.0. Obes Res Clin Pract 2021;15:3:191–204. https://doi.org/10.1016/j.orcp.2021.03.014.

20. Praxedes DR, Silva-Júnior AE, Macena ML, Oliveira AD, Cardoso KS, Nunes LO, et al. Prevalence of food addiction determined by the Yale Food Addiction Scale and associated factors: a systematic review with meta-analysis. Eur Eat Disord Rev. 2022:30(2):85–95. https://doi.org/10.1002/erv.2878.

21. Lee C, Gao M, Ryff CD. Conscientiousness and smoking: do cultural context and gender matter? Front Psychol. 2020;11:1593. https://doi.org/10.3389/fpsyg.2020.01593.

22. Caton SJ, Nolan LJ, Hetherington MM. Alcohol, appetite and loss of restraint. Curr Obes Rep. 2015;4(1):99–105. https://doi.org/10.1007/s13679-014-0130-y.

23. Meule A. An addiction perspective on eating disorders and obesity. In Herpertz-Dahlmann B, Hebebrand, J, editors. Eating Disorders and Obesity in Children and Adolescents. Missouri: Elsevier Health Sciences; 2018.

24. Romero X, Aguera Z, Granero R, Sánchez I, Riesco N, Jiménez-Murcia S, et al. Is food addiction a predictor of treatment outcome among patients with eating disorder? Eur Eat Disord Rev. 2019;27:700–11. https://doi.org/10.1002/erv.2705.

25. Wenzel KR, Weinstock J, McGrath AB. The clinical significance of food addiction. J Addict Med 2020:14:e153–9. https://doi.org/10.1097/ADM.0000000000000626.

26. Carter JC, Van Wijk M, Rowsell M. Symptoms of ‘food addiction’ in binge eating disorder using the Yale Food Addiction Scale version 2.0. Appetite 2019;133:362–9. https://doi.org/10.1016/j.appet.2018.11.032.

27. Gearhardt AN. Neural correlates of food addiction. Arch Gen Psychiatry. 2011;68:808. https://doi.org/10.1001/archgenpsychiatry.2011.32.

28. Hardee JE, Phanseuf C, Cope L, Zucker R, Gearhardt A, Heitze M. Neural correlates of inhibitory control in youth with symptoms of food addiction. Appetite. 2020;148:104578. https://doi.org/10.1016/j.appet.2019.104578.

29. Meule A. A critical examination of the practical implications derived from the food addiction concept. Curr Obes Re. 2019;8:11–7. https://doi.org/10.1007/s13679-019-0326-2.

30. Lowe MR, Arigo D, Butryn ML, Gilbert JR, Sarwer D, Stice E. Hedonic hunger prospectively predicts onset and maintenance of loss of control eating among college women. Health Psychol. 2015;35:238–44. https://doi.org/10.1037/healt0000291.

31. Gearhardt AN, Corbin WR, Brownell KD. Development of the Yale Food Addiction Scale Version 2.0. Psychol Addict Behav 2016:30:113–21. https://doi.org/10.1037/adb0000136.

32. Tanofsky-Kraff M, Yanovski SZ, Schvey NA, Olsen CH, Gustafson J, Yanovski JA. A Prospective study of loss of control eating for body weight gain in children at high risk for adult obesity. Int J Eat Disord. 2009;42(1):26–30. https://doi.org/10.1002/eat.20580.

33. Hilbert A, Hartmann AS, Czaja J, Schoei D. Natural course of preadolescent loss of control eating. J Abnorm Psychol. 2013;122:684–93. https://doi.org/10.1037/a0033330.

34. Meule A, Gearhardt AN. Ten years of the Yale Food Addiction Scale: a review of version 2.0. Curr. Addict. Reports. 2019;6:3:218–28. https://doi.org/10.1007/s40429-019-00261-3.

35. Davis C. Compulsive overeating as an addictive behavior: overlap between food addiction and binge eating.
disorder. Curr Obes Rep. 2013;2:171–8. https://doi.org/10.1007/s40429-019-00261-3.

36. Davis C, Loxton NJ. Addictive behaviors and addiction-prone personality traits: associations with a dopamine multilocus genetic profile. Addict Behav. 2013;38:2306–12. https://doi.org/10.1016/j.addbeh.2013.02.012.

37. Jennison KM. The short-term effects and unintended long-term consequences of binge drinking in college: a 10-year follow-up. Am J Drug Alcohol Abuse. 2004;30:659–84. https://doi.org/10.1080/10520800490261728.

38. Kaleta D, Polańska K, Korytkowski P, Usidame B, Bąk-Romaniszyn L. Patterns of nicotine dependence in four Eastern European countries. 2015:15.1189. https://doi.org/10.1186/s12889-015-2537-0.

39. Di Giacomo E, Aliberti F, Pescatore F, Santorelli M, Pessina R, Placenti V, et al. Disentangling binge eating disorder and food addiction: a systematic review and meta-analysis. Eat Weight Disord. 2022;1:3. https://doi.org/10.1007/s40519-021-01354-7.

40. Rolland B, Naassila M. Binge drinking: current diagnostic and therapeutic issues. CNS Drugs. 2017;31:181–6. https://doi.org/10.1007/s40263-017-0413-4.

41. Schulte EM, Grilo CM, Gearhardt AN. Shared and unique mechanisms underlying binge eating disorder and addictive disorders. Clin Psychol Rev. 2016;44:125–39. https://doi.org/10.1016/j.cpr.2016.02.001.

42. Bonder R, Davis C, Kuk JL, Loxton NJ. Compulsive “grazing” and addictive tendencies towards food. Eur Eat Disord Rev. 2018;26:569–73. https://doi.org/10.1002/evr.2642. This study was published in 2018 but is the first and only to look at grazing in FA in a general population sample. Results showed that grazing represents a pattern of intake in those with FA.

43. Latner JD, Mond JM, Kelly MC, Haynes SN, Hay PJ. The loss of control over eating scale: development and psychometric evaluation. Int J Eat Disord. 2014;47:647–59. https://doi.org/10.1002/eat.22296.

44. Grilo CM, Masheb RM, Wilson GT, Guerguevica R, White MA. Cognitive-behavioral therapy, behavioral weight loss, and sequential treatment for obese patients with binge-eating disorder: a randomized controlled trial. J Consult Clin Psychol. 2011;79:675–85. https://doi.org/10.1037/a0025049.

45. Conceição EM, Mitchell JE, Engel SG, Machado PPP, Lancaster K, Wonderlich SA. What is “grazing”? Reviewing its definition, frequency, clinical characteristics, and impact on bariatric surgery outcomes, and proposing a standardized definition. Surg Obes Relat Dis. 2014;10:973–82. https://doi.org/10.1016/j.soard.2014.05.002. This study was published in 2014 but provides an extensive review of grazing in the literature. It is also the first and only to provide a consensus definition of grazing based on research and clinical opinion.

46. Conceição EM, Mitchell JE, Machado PPP, Vaz AR, Pinto-Bastos A, Ramalho S, et al. Repetitive eating questionnaire [Rep(eat)-Q]: enlightening the concept of grazing and psychometric properties in a Portuguese sample. Appetite. 2017;117:351–8. https://doi.org/10.1016/j.appet.2017.07.012. This study was published in 2017 but establishes the two sub-types of grazing: compulsive and non-compulsive.

47. Reas DL, Wisting L, Kapstad H, Lask B. Nibbling: frequency and relationship to BMI, pattern of eating, and shape, weight, and eating concerns among university women. Eat Behav. 2012;13:65–6. https://doi.org/10.1016/j.eatbeh.2011.10.005.

48. Heriseanu AI, Hay P, Corbit L, Touyz S. Grazing in adults with obesity and eating disorders: a systematic review of associated clinical features and meta-analysis of prevalence. Clin Psychol Rev. 2017;58:16–32. https://doi.org/10.1016/j.cpr.2017.09.004.

49. Heriseanu AI. Relating goal-directed behaviour to grazing in persons with obesity with and without eating disorder features. J Eat Disord. 2020;8(1):1–14. https://doi.org/10.1186/s40337-020-00324-1. Study on grazing and goal-directed behaviour in a sample of those with obesity, with and without eating-disorder symptoms. In the sample of those with obesity and eating-disorder symptoms, grazing severity was associated with goal-directed behaviour. The authors suggested that grazing may represent a compensatory behavior in an effort to control overconsumption, but that this strategy is unhelpful in the long term.

50. Heriseanu AI, Hay P, Touyz S. Grazing behaviour and associations with obesity, eating disorders, and health-related quality of life in the Australian population. Appetite. 2019;143:104396. https://doi.org/10.1016/j.appet.2019.104396. An important study establishing an association between grazing and loss of control. It was found that compulsive grazing is a problematic eating behaviour in the general population, in those with overweight/obesity, and in those who engage in bingeing behaviours.

51. Preuss H, Pinnow M, Schnicker K, Legenbauer T. Improving inhibitory control abilities (ImpulsE)—a promising approach to treat impulsive eating? Eur Eat Disord Rev. 2017;25:533–43. https://doi.org/10.1002/erv.2544.

52. Saunders R. “Grazing”: a high-risk behavior. Obes Surg. 2004;14:98–102. https://doi.org/10.1381/096089204772787374.

53. Conceição E, Mitchell JE, Vaz AR, Bastos AP, Ramalho S, Silva C, et al. The presence of maladaptive eating behaviors after bariatric surgery in a cross sectional study: importance of picking or nibbling on weight regain. Eat Behav. 2014;15:558–62. https://doi.org/10.1016/j.evr.2544.

54. Ivezaj V, Wiedemann AA, Lawson JL, Grilo CM. Food addiction in sleeve gastrectomy patients with loss-of-control eating. Obes Surg. 2019;29:2071–7. https://doi.org/10.1007/s11695-019-03805-8.

55. Constant A, Mioird R, Thibault R, Val-Lailliet D. Meeting of minds around food addiction: Insights from addiction medicine, nutrition, psychology, and neurosciences. Nutrients. 2020;12(11):1–24. https://doi.org/10.3390/nu12113564.

56. Mechanick JI, Apovian C, Brethauer S, Garvey WT, Joffe AM, Kim J, et al. Clinical practice guidelines for the perioperative nutrition, metabolic, and nonsurgical support of patients undergoing bariatric procedures - 2019 update: Endocr Pract 2019;25:1346–59. https://doi.org/10.4158/GL-2019-0406.

57. Bonder R, Davis C, Kuk J, Ardern C, Kamran E, Wharton S. Grazing’ and its association with FA in a sample of weight-loss seeking adults with overweight/obesity. In preparation, 2022. The first and only study to look at grazing in FA in a high-risk sample of weight-loss seeking individuals with overweight/obesity. Results showed that grazing is a significant pattern of intake in those with FA.

58. Epstein EB. The Experience of recovery from food addiction. J. Chem. Inf. Model. 2019.

59. Rehm J, Gmel GE, Gmel G, Hasan OSM, Imtiaz S, Popova S, et al. The relationship between different dimensions of alcohol use and the burden of disease—an update. Addiction. 2017;112:968–1001. https://doi.org/10.1111/adn.13757.

60. Sarah Allen Benton. Understanding the high-functioning alcoholic: professional views and personal insights. London: Greenwood Publishing Group; 2009.

61. Epstein EE, Labouvie E, McCrady BS, Swingle J, Wern J. Development and validity of drinking pattern classification: binge, episodic, sporadic, and steady drinkers in treatment for...
alcohol problems. Addict Behav. 2004;29:1745–61. https://doi.org/10.1016/j.addbeh.2004.03.040.
62. Shiftman S, Tindle H, Li X, Scholl S, Dunbar M, Mitchell-Miland C. Characteristics and smoking patterns of intermittent smokers. Exp Clin Psychopharmacol. 2012;20(4):264–77. https://doi.org/10.1037/a0027546.
63. Shiftman S, Ferguson SG, Dunbar MS, Scholl SM. Tobacco dependence among intermittent smokers. Nicotine Tob Res. 2012;14:1372–81. https://doi.org/10.1093/ntr/nts097.
64. DiFranza JR, Rigotti NA, McNeill AD, Ockene JK, Savageau JA, St Cyr D, et al. Initial symptoms of nicotine dependence in adolescents. Tob Control. 2000;9:313–9. https://doi.org/10.1136/tc.9.3.313.
65. Scragg R, Wellman RJ, Laugesen M, DiFranza JR. Diminished autonomy over tobacco can appear with the first cigarettes. 2008;33:5:689–698. https://doi.org/10.1016/j.jaddbeh.2007.12.002.
66. Lipari RN, Van Horn SL. Trends in substance use disorders among adults aged 18 or older. The CBHSQ Report, 2013. Available from: https://pubmed.ncbi.nlm.nih.gov/28792721/.
67. Piernas C, Popkin BM. Food portion patterns and trends among U.S. children and the relationship to total eating occasion size, 1977–2006. J Nutr 2011:141:1159–64. https://doi.org/10.3945/jn.111.138727.
68. Schulte EM, Avena NM, Gearhardt AN. Which foods may be addictive? The roles of processing, fat content, and glycemic load. PLoS ONE. 2015;10:1–19. https://doi.org/10.1371/journal.pone.0117959.
69. Morris MI, Beilharz JE, Maniam J, Reichelt AC, Westbrook RF. Why is obesity such a problem in the 21st century? The intersection of palatable food, cues and reward pathways, stress, and cognition. Neurosci Biobehav Rev. 2015;58:36–45. https://doi.org/10.1016/j.neubiorev.2014.12.002.
70. Berridge KC, Robinson TE. Liking, wanting and the incentive-sensitization theory of addiction. Am Psychol. 2016;71(8):670–9. https://doi.org/10.1037/amp0000059.
71. Schulte EM, Joyner MA, Schiestl ET, Gearhardt AN. Future directions in “food addiction”: next steps and treatment implications. Curr Addict Reports. 2017;4(2):165–71. https://doi.org/10.1007/s40429-017-0140-4.
72. Rogers PJ. Food and drug addictions: similarities and difference. Pharmacol Biochem Behav. 2017;153:182–90. https://doi.org/10.1016/j.pbb.2017.01.001.
73. Schulte EM, Joyner MA, Potenza MN, Grilo CM, Gearhardt AN. Current considerations regarding food addiction. Curr Psychiatry Rep. 2015;17:19. https://doi.org/10.1007/s11920-015-0563-3.