

# Five years of the *Yale Food Addiction Scale*: Taking stock and moving forward

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**Abstract** Some forms of overeating show both behavioral and neurobiological similarities to substance use disorders. Accordingly, a possible addiction to food has been discussed for decades, and the debate has received increased scientific and public attention since the beginning of the twenty-first century. In 2009, the *Yale Food Addiction Scale* (YFAS) was developed in an attempt to provide a standardized self-report instrument for the assessment of food addiction based on the diagnostic criteria for substance dependence. Since then, the YFAS has been used in numerous studies and celebrates its fifth anniversary this year. This article presents an overview of the YFAS and its adaptations, which includes a detailed description of scoring instructions and a supplementary SPSS syntax. Furthermore, psychometric properties and correlates of the YFAS, as well as prevalence rates of food addiction diagnoses and symptoms in different populations, are reviewed. Finally, shortcomings of the scale and future directions for food addiction research and revisions of the YFAS are discussed.

**Keywords** Food addiction · Yale Food Addiction Scale · DSM-IV · DSM-5 · Substance use disorder · Obesity · Binge eating

## Introduction

For decades, researchers have discussed whether some forms of overeating may represent an addictive behavior and if specific foods may have an addictive potential [1]. Although this idea has been sporadically mentioned and investigated in the second half of the twentieth century, scientific as well as public interest in *food addiction* strongly increased in the 2000s [2, 3]. This revival of the food addiction concept was partly driven by the pandemic increase of overweight and obesity rates worldwide and neuroimaging studies showing similarities in brain functioning between individuals with obesity and those with substance dependence [4]. These findings were further corroborated by animal models revealing addiction-like behaviors and brain alterations associated with sugar or high-calorie food consumption in rodents [5, 6].

However, the concept of food addiction is still a controversial and heavily debated topic [7–12]. Some of the critical remarks, for example, include that although similarities in brain mechanisms of food and drug reward exist, there are also substantial differences [13]. Moreover, it has been argued that human studies on brain mechanisms in obesity or binge eating disorder (BED) are inconsistent [7]. Finally, some researchers disagree about the precise definition of food addiction, and support for the existence of some food addiction symptoms is restricted to animal studies [7, 11]. Unfortunately, objectively measuring food addiction in humans is not an easy task. For example, it is not possible to diagnose people with behavioral or (neuro-)physiological measures due to practical reasons and a lack of established research findings. Instead, interviews or self-report

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questionnaires provide feasible tools to start to identify individuals who may be experiencing an addictive response to food. Using those measures, it can be tested whether these individuals exhibit behavioral, cognitive, and physiological/neuronal correlates of addiction. Thus, the present article briefly outlines how researchers have attempted to assess food addiction in humans in the past and how it is measured with the Yale Food Addiction Scale (YFAS). Hereinafter, findings from studies in which the YFAS was used are reported and future directions are discussed.

## Assessment of Food Addiction

In early studies on eating behavior from an addiction perspective, the approach for measuring food addiction was rather indirect. In the 1980s, for example, researchers conducted studies on the parallels between substance dependence and bulimia nervosa (BN). Participants completed personality questionnaires such as the *MacAndrew Scales* or the *Eysenck Personality Questionnaire* and then scores were compared between individuals with BN and individuals with substance dependence [14–17]. A lack of differences between groups was interpreted as individuals with BN having an ‘addictive personality’.

A more straightforward approach was chosen in some studies on ‘chocolate addiction’ in the 1990s. Participants were recruited via advertisements, which asked “are you a chocolate addict?” [18–20]. Obviously, assessment of food addiction based on self-identification is markedly vulnerable to bias. Moreover, validity of such questions is limited by the fact that most nonprofessional participants do not know how addiction is defined.

Hence, a reasonable approach is to ask participants about addiction symptoms as outlined in diagnostic manuals and to classify them as being addicted only when several of those criteria are met. For example, two studies used a structured interview for the assessment of *Goodman’s Addictive Disorder* criteria [21] in individuals with anorexia nervosa (AN), BN, or BED. It was found that between 35 and 48 % of participants with AN or BED, and 65 % of participants with BN, met the full criteria for addictive disorder [22, 23]. However, a potential downside of using those criteria is that they are quite conservative and that the problematic behavior is not further specified. That is, respondents may misinterpret questions and include behaviors other than eating (e.g., purging). This would also explain why many individuals with AN met the addictive disorder criteria even though AN is not related to an increased substance use (i.e., food consumption).

Thus, a more clear-cut procedure is to orient on the diagnostic criteria for substance dependence. Cassin and von Ranson [23] substituted the references to ‘substance’ with

‘binge eating’ in a structured interview on the substance dependence criteria of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV). Using this interview technique, they found that 92 % of participants with BED met the full criteria for substance dependence. However, the authors also noted that participants’ responses may have been influenced by demand characteristics and that reliability and validity of their interview assessment was uncertain [23].

## Yale Food Addiction Scale (YFAS)

### Development, Scoring, and Psychometric Properties

In an attempt to overcome those heterogeneous definitions and measures of food addiction and its symptoms, the YFAS was developed in 2009 in order to provide a standardized assessment tool [24]. This 25-item instrument is based on the seven substance dependence criteria in the DSM-IV (Table 1) and, accordingly, assesses seven food addiction symptoms as well as a clinically significant impairment or distress (Appendix A). Originally, two additional items were included for exploration of the specific kinds of food with which respondents have difficulties controlling consumption. However, these two items have not received much attention in subsequent studies and may be omitted when using the scale.<sup>1</sup>

Participants are instructed to refer to the past 12 months when answering questions. Different response categories are as follows: frequency (e.g., ranging from ‘never’ to ‘four or more times a week or daily’) and dichotomous scoring (‘yes’ or ‘no’). Responses are then recoded to all be dichotomous (Appendix A). Three items act as primers for the subsequent items and are not scored. If at least one question of each criterion is scored as one, then this criterion is met. A continuous symptom count can be calculated by adding up the criteria met (except impairment/distress). That is, the symptom count can range between zero and seven symptoms. A dichotomous score can also be calculated: food addiction can be ‘diagnosed’ when at least three symptoms *and* the criterion of a clinically significant impairment or distress is met. An SPSS syntax for those calculations can be found in the supplementary material.

The YFAS has a one-factor structure [24, 25]. Kuder–Richardson’s alpha coefficient is usually reported as an indication of internal consistency because of the different response categories. That is, internal consistency is calculated using the dichotomized item scores (note that SPSS automatically

<sup>1</sup> In one study [31], the most often selected foods were chocolate (selected by 54 % of participants), candy (46 %), cookies (25 %), chips (25 %), pastries (21 %), cake (21 %), pasta (18 %), pizza (18 %), ice cream (16 %), and French fries (14 %). These foods correspond to the most often craved foods identified in previous studies on food craving [61].

**Table 1** Diagnostic criteria of substance use disorder according to the DSM-IV and DSM-5

1. Substance often taken in larger amounts or over a longer period than was intended
2. Persistent desire or unsuccessful efforts to cut down or control substance use
3. Great deal of time is spent in activities necessary to obtain or use the substance or recover from its effects
- 4. Craving, or a strong desire or urge to use the substance**
- 5. Recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home**
- 6. Continued use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance**
7. Important social, occupational, or recreational activities are given up or reduced because of substance use
- 8. Recurrent substance use in situations in which it is physically hazardous**
9. Substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance
10. Tolerance
  - a. need for markedly increased amounts of the substance to achieve intoxication or desired effect
  - b. markedly diminished effect with continued use of the same amount of the substance
11. Withdrawal
  - a. withdrawal syndrome (differs by substance)
  - b. substance is taken to relieve or avoid withdrawal symptoms

Criteria printed in boldface are new in DSM-5. Substance use disorder can be diagnosed when a problematic pattern of substance use leads to clinically significant impairment or distress and symptoms occurred within the past 12 months. Severity can be specified as follows: mild (2–3 symptoms), moderate (4–5 symptoms), severe (6 or more symptoms).

DSM-5 Diagnostic and Statistical Manual of Mental Disorders

calculates the Kuder–Richardson coefficient when dichotomous scores are used and ‘coefficient alpha’ is selected). In the original validation study, internal consistency was  $\alpha=0.86$  [24•] and ranged between  $\alpha=0.76$  and  $0.92$  in subsequent studies [26•, 27•, 28–30] (note that differences in internal consistency may emerge across studies if some researchers use all items and others exclude the primer items or the items assessing a clinically significant impairment or distress).

#### Translations

The YFAS also is available in German [31]. Its one-factor structure was replicated and internal consistency was comparable to the English version ( $\alpha=0.81$ – $0.83$  [32, 31]). Moreover, validity indices were similar to those reported for the original version, such that medium-to-high positive correlations could be found with the *Eating Attitudes Test*, and a measure of emotional eating and no or small correlations were

found with the *Behavioral Inhibition System/Behavioral Activation System* [31, 24•]. Factor structure and internal consistency of the German version were further replicated in a sample of obese candidates for bariatric surgery ( $\alpha=0.82$  [33]). Finally, a French version of the YFAS was employed in one study and internal consistency was  $\alpha=0.90$  [34].

#### Modified Yale Food Addiction Scale (mYFAS)

Most recently, a short form of the YFAS has been proposed (modified YFAS [mYFAS]) [35•]. It consists of nine items only, with one item for assessing each of the seven symptoms of substance dependence in the DSM-IV and two items assessing the presence of a clinically significant impairment or distress (Appendix B and [supplementary material](#)). Internal consistency of the seven questions measuring food addiction symptoms (i.e., without the questions on impairment or distress) ranged between  $\alpha=0.75$  and  $0.84$ . Importantly, the prevalence rates of food addiction diagnoses using the mYFAS, as well as its validity indices, were comparable to those found using the full version [35•].

#### Yale Food Addiction Scale for Children (YFAS-C)

A child version of the YFAS (YFAS-C) was recently developed by changing the item wording to be appropriate for children [36]. Specifically, the adult YFAS was altered to refer to age-appropriate activities (e.g., references related to employment were changed to school; parental interactions were included) and the questions were edited to lower the reading level (Flesch–Kincaid reading level=grade 2.7). Response categories were also rephrased to facilitate comprehension (ranging from ‘never’ to ‘always’). Other minor changes included that one item with a dichotomous response format in the adult version was transformed to a continuously scored question, and new scoring thresholds were established (Appendix C and [supplementary material](#)). Similar to the adult version, the YFAS-C has a one-factor structure, and internal consistency was  $\alpha=0.78$  in the validation study [36].

#### Prevalence of YFAS Symptoms

The most common food addiction symptom as assessed with the YFAS is a ‘persistent desire or unsuccessful efforts to cut down or control eating’ [35•, 37]. Notably, almost 100 % of obese individuals fulfill this criterion [28, 33, 38, 25, 39]. Other commonly endorsed symptoms are ‘continued eating despite physical or psychological problems’ and ‘tolerance’, particularly in obese samples [28, 33, 38, 25, 39]. The remaining symptoms (‘consumption of large amounts or over a longer period than intended’, ‘spending much time obtaining

food or eating or recover from its effects', 'giving up important activities', and 'withdrawal symptoms') are less common, particularly in nonclinical samples [35, 37], but are nonetheless endorsed by a substantial proportion of obese individuals [38, 25, 33, 39].

In a recent study with individuals with BN, the most often endorsed symptom also was 'a persistent desire or unsuccessful efforts to cut down or control eating', corresponding to previous studies. Yet, two other most often endorsed symptoms were 'giving up important activities' and 'withdrawal symptoms', while the least often endorsed symptom was 'tolerance' [40]. A possible explanation for this may simply be an effect of age: samples of obese individuals usually have a higher age than do young women with BN, and development of tolerance may primarily occur after several years of addiction-like eating. Similarly, the most often endorsed food addiction symptoms in children were an 'inability to cut down' and 'giving up important activities' while 'tolerance', 'withdrawal', and 'continued use despite problems' were the least often endorsed symptoms [36].

To conclude, although 'a persistent desire or unsuccessful efforts to cut down or control eating' is the most frequently met food addiction criterion across different studies, endorsement rates of the other food addiction symptoms differ between nonclinical samples, individuals with BN, and obese individuals.

### Prevalence of YFAS Diagnoses

Prevalence rates of food addiction diagnoses according to the YFAS range between approximately 5 and 10 % in student and community samples [24, 31, 41, 42, 35, 32]. Similarly, prevalence of food addiction as identified by the YFAS-C was 7 % in children [36]. These numbers need to be interpreted with caution, as food addiction may be overestimated as a result of selection bias, for example, in web-based studies [24, 31, 32].

Nonetheless, food addiction prevalence is increased in obese samples, ranging between approximately 15 and 25 % [29, 26, 27, 28, 43]. Even higher prevalence rates (about 30–50 %) could be found in morbidly obese bariatric patients or obese individuals with BED [38, 25, 33, 44]. Notably, all participants with current bulimic symptomatology received a YFAS diagnosis in the study described above. However, sample size was small ( $n=26$  [40]).

To conclude, studies using the YFAS have found that about 5–10 % of participants in primarily nonclinical samples receive a food addiction diagnosis. Prevalence rates are higher in obese samples, and food addiction diagnoses most frequently occur in individuals with binge eating behaviors such as those with BED or BN [45, 46].

### Correlates of YFAS Scores

#### Relationships With Body Mass and Weight Change

As mentioned above, the prevalence of YFAS diagnoses is higher in obese samples than in non-obese samples. However, many studies did not find an association between body mass index (BMI) and YFAS diagnoses or symptoms [29, 27, 28, 34, 26, 47, 32, 48, 49]. This may be explained by the fact that study samples were restricted to either predominantly normal-weight individuals or obese individuals only and that there may be a nonlinear relationship between BMI and food addiction symptomatology [45, 46]. Specifically, the positive relationship between the YFAS and BMI in non-obese samples may be attenuated by individuals who receive a YFAS diagnosis, but engage in compensatory behaviors. Indeed, even a negative relationship between YFAS symptoms and BMI was found in individuals with BN [40]. In individuals with morbid obesity, positive relationships between BMI and YFAS scores may be rendered impossible by ceiling effects [46]. Following this line of thought, positive associations between BMI and YFAS scores may particularly be observed in samples with a wide range in BMI and, indeed, such studies clearly demonstrated a positive relationship [30, 35, 41, 31]. In children, the YFAS-C symptom count was also positively related to BMI [36].

Two studies examined whether food addiction symptomatology at baseline is related to treatment success in weight-loss interventions. In one of those studies, YFAS symptoms were negatively correlated with weight loss after 7 weeks of a behavioral weight-loss program, suggesting that food addiction symptomatology may adversely affect treatment success in obese individuals [29]. However, this finding could not be replicated in a more recent study [43]. Future research on the clinical utility of the YFAS is clearly needed. Another gap in the literature is whether individuals with more addictive-like eating are more prone to regain weight following treatment. Further, there has been no examination of how patients with higher YFAS scores respond to treatment for disordered eating or whether the addition of addiction-related treatment techniques (e.g., motivational interviewing, cue-exposure/response-prevention) is helpful for these individuals. This will be an essential future direction for evaluating the usefulness of the YFAS in clinical settings.

#### Relationships With Other Eating-Related Constructs

Scores on the YFAS are strongly related to higher eating disorder symptomatology [39, 31, 24, 44], particularly to binge eating such as in individuals with BED [26, 38, 25] or BN [40]. Individuals receiving a YFAS diagnosis report experiencing more intense and more frequent food cravings than those who do not receive a YFAS diagnosis [39, 32, 26].

Moderate-to-large relationships can also be found with other problematic eating behaviors such as emotional eating

[31, 24••, 47••, 26•, 44, 29]. Similarly, the YFAS-C symptom count was positively related to emotional overeating in children [36]. Positive correlations have also been found between YFAS symptoms and scores on the *Palatable Eating Motives Scale*, which measures eating palatable foods for social reasons and emotion regulation [50].

Positive but weaker associations were observed with external eating behavior [31, 47••, 26•, 40], and weak or no relationships have been found with restrained eating [25, 49, 39, 31, 38]. Nevertheless, the number of food addiction symptoms is negatively correlated with perceived self-regulatory success in dieting [51].

One study investigated macronutrient intake in relation to YFAS scores. Participants retrospectively reported their average use of food items in the past 12 months using a food frequency questionnaire. Macronutrient intake was estimated as percent of total calorie intake from those data. Participants with food addiction had higher relative calorie intake from fat and protein, but not carbohydrates, as compared with those with no food addiction [41].

Apart from those findings from questionnaire-based studies, experimental studies on correlates of the YFAS using behavioral or physiological measures are rare. Preliminary evidence in a student sample suggests that women exhibiting signs of food addiction may show an attentional or approach bias towards high-calorie food cues as indicated by accelerated reactions to those stimuli in a go/no-go task [48]. Those results match well with a neuroimaging study showing that food addiction symptoms correlated with elevated activation in reward circuitry in response to an anticipated receipt of food [47••]. Moreover, this study also found that individuals with higher food addiction scores exhibited reduced activation of inhibitory regions in response to food intake [47••]. In a recent study in obese individuals, participants who received a food addiction diagnosis could be distinguished from those not receiving a food addiction diagnosis on a composite genetic index of dopamine signaling. Specifically, food addicted participants had a higher multilocus genetic profile score (reflecting elevated dopamine signaling), and this relationship was mediated by self-reported trait food craving [27••]. Most recently, it could be shown that administration of a dopamine agonist (methylphenidate) differentially affected food consumption in overweight individuals with or without an YFAS diagnosis [52]. Thus, elevated YFAS scores appear to be related to reward-responsive overeating as indicated by self-report as well as neurobiological markers.

#### Relationships With Other Constructs Not or Indirectly Related to Eating

In addition to higher eating pathology, food addiction symptomatology is also associated with higher general psychopathology. For instance, individuals with a food addiction

diagnosis show higher rates of depression and report higher scores on the *Behavioral Inhibition System* [31, 24••, 38, 25, 26•, 28, 44, 29]. In obese individuals, higher rates of attention-deficit hyperactivity disorder have been found in those with a YFAS diagnosis [26•]. In individuals with BN, food addiction symptoms were highly correlated with borderline personality disorder symptomatology [40]. Similarly, food addiction symptoms correlated with lower self-esteem and more difficulties in emotion regulation in individuals with BED [38, 25].

A cross-sectional study in which the mYFAS was used found a positive relationship between physical and sexual child abuse severity and the presence of adult food addiction in women [42]. Food addiction symptoms are also correlated with issues related to weight and body image such as more pronounced anti-fat attitudes, higher weight bias internalization, and feelings of shame regarding one's own body [29].

Impulsivity is considered a stable personality trait that represents a risk factor for several mental disorders, for example substance use disorders [53]. Likewise, individuals with food addiction have higher levels of impulsivity as indicated by self-report measures and behavioral tasks such as delay discounting [31, 26•, 34]. However, it appears that YFAS scores are particularly associated with specific aspects of impulsivity such as attentional impulsivity [54, 39, 48, 49] as well as urgency and a lack of perseverance [30]. Conversely, YFAS scores seem to be unrelated to other impulsivity-related traits such as sensation or novelty seeking [34, 30].

Some studies examined the co-occurrence of food addiction and substance use disorders. In quite a few of them, YFAS scores were unrelated to substance use or substance use disorders [31, 44, 24••, 38, 25]. In a large-scale study in middle-aged and older women, those with food addiction were more likely to be nonsmokers [35•]. Furthermore, those who reported being former smokers were more likely to receive a food addiction diagnosis [35•]. It may be speculated whether food addiction substitutes or acts as a replacement for tobacco addiction or vice versa. Similarly, gastric bypass patients who had a higher YFAS symptom count before bariatric surgery (based on retrospective reports) were more likely to have post-bariatric substance misuse, suggesting a possible 'addiction transfer' [55]. A recent study reported a trend towards less alcohol use and associated problems in obese individuals with food addiction than in those without food addiction. Importantly, interactive effects between YFAS scores and self-reported impulsivity when predicting problematic alcohol use were found, suggesting that the relationship between substance use and food addiction may be more complex [49]. Specifically, simply looking at co-prevalence data may be insufficient as the association between substance use and food addiction might be influenced by third variables such as impulsivity [56].

## Summary and Outlook

### Psychometric Properties and Stability

Across different studies, it could be shown that the YFAS has a one-factor structure and adequate internal consistency, which ranges between approximately  $\alpha = 0.80$  and  $0.90$ . As yet, no study has investigated retest-reliability. While most studies that investigate retest-reliability of self-report instruments administer the same measure after some weeks, such an approach may be inappropriate for the YFAS, as items refer to the past 12 months in order to correspond to the diagnostic criteria for substance dependence in DSM-IV. Similarly, the timeframe may need to be modified from 12 months to, for example, 1 month (cf. [43]), in order to determine whether the YFAS is sensitive to treatment changes. Preliminary evidence suggests that YFAS scores are decreased after treatment. In a recent study in participants who reported having a history of BN, but did not show signs of current bulimic symptomatology, YFAS diagnoses and symptoms were significantly lower than in participants with current bulimic symptoms [40]. Moreover, prevalence of YFAS diagnoses in 26 obese individuals was 23 % ( $n=6$ ) after bariatric surgery (A. Meule, unpublished data), which is substantially lower than prevalence rates reported in obese individuals before bariatric surgery [33, 44]. Similarly, prevalence of YFAS diagnoses in 178 obese individuals was 5 % ( $n=8$ ) at the end of a behavioral weight-loss treatment (M.R. Lent, personal communication), which is lower than prevalence rates reported in obese individuals seeking behavioral weight-loss treatment [43, 29].

### Correlates and Validity

Scores on the YFAS are strongly associated with eating pathology, particularly binge eating, as well as with measures of general psychopathology such as depression. As a result, it has been proposed recently that food addiction as measured with the YFAS may merely represent a more severe form of BED [57, 58]. However, this view is challenged by the fact that there are also individuals without BED who receive a YFAS diagnosis [26, 40]. Nevertheless, the overlap between binge eating and YFAS scores is large, and food addiction appears to be primarily related to binge eating and only secondarily related to higher body mass.

To date, most studies in which the YFAS was used were based on self-report questionnaires only. Thus, there is an urgent need to go beyond cross-sectional, questionnaire-based studies and investigate food addiction in longitudinal or experimental studies. Few

investigations exist to show that individuals with or without a YFAS diagnosis (or with a high or low symptom count) can be differentiated by behavioral and brain responses to food cues and a dopaminergic genetic profile, in addition to differences in self-report measures [48, 27••, 47••]. Yet, sophisticated experimental or field studies are necessary to further support validity of the YFAS. For example, although a substantial proportion of individuals meet the criteria of ‘tolerance’ and ‘withdrawal symptoms’ as assessed with the YFAS, other evidence for those symptoms is restricted to animal studies. Elaborated longitudinal studies in which food intake is objectively measured are needed to further support the existence of these symptoms in humans. Other studies may make use of ‘ecological momentary assessment’ in order to reveal if individuals with a YFAS diagnosis actually spend more ‘time in activities necessary to obtain food, eat, and recover from overeating’ than do individuals not receiving a YFAS diagnosis.

### Adaptations and Future Versions

Most recently, a short form of the YFAS, the mYFAS, was introduced and it appears that food addiction symptomatology can be assessed sufficiently well with this reduced version. Moreover, a child version of the YFAS, the YFAS-C, was presented, the psychometric properties and validity indices of which were comparable to the adult version. However, all of these versions assess food addiction symptoms based on the substance dependence criteria in the DSM-IV. However, in 2013, a newly revised version of the DSM, the DSM-5, was published that included substantial changes to the substance dependence criteria. Specifically, four criteria were added, including (1) craving, or a strong desire or urge to use the substance; (2) recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home; (3) continued use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of the substance; and (4) recurrent substance use in situations in which it is physically hazardous (Table 1).

Future investigations need to determine if and how these new criteria can be translated to eating behavior and whether their application will lead to different prevalence rates and correlates of food addiction [59]. Preliminary evidence based on a qualitative analysis of responses in a semi-structured interview suggest that obese individuals with BED, and to a lesser extent also those without BED, easily fulfill the full criteria for substance use disorder as outlined in the DSM-5 [60•]. Some of the DSM-5 criteria that were previously used to signify substance abuse are highly related to the

mind altering, intoxicating nature of the substance (e.g., use in physically hazardous situations) and the extent to which they will apply to addictive consumption with little intoxication (as is the case with cigarettes and potentially food) is unclear. Yet, craving was also added to the DSM-5 as an indicator of addiction, and craving for palatable foods has been strongly implicated in binge- and addictive-like eating behavior [26•, 32, 39]. Alterations to the YFAS to reflect changes in the DSM are currently under way (A.N. Gearhardt, unpublished data), and further research will be needed to evaluate this new version.

In conclusion, the development of the YFAS has provided an important measure to evaluate whether an addictive process contributes to certain types of problematic eating behavior. Although the YFAS is not sufficient evidence that ‘food addiction’ exists, it does provide a standardized tool to identify individuals who are the

most likely to be experiencing an addictive response to food. Additionally, the YFAS allows for exploration of the negative consequences that are most commonly related to ‘food addiction’, such as binge eating and obesity. Finally, the development of the YFAS allows for more rigorous future studies to test the ‘food addiction hypothesis’ by examining whether the psychological, behavioral, cognitive, and physiological/neural correlates of addiction are also associated with addictive-like eating phenotypes.

**Compliance with Ethics Guidelines**

**Conflict of Interest** Adrian Meule and Ashley N. Gearhardt declare that they have no conflict 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.

**Appendix A**

**Table 2** Items and scoring of the Yale Food Addiction Scale

Item	Response categories					Scoring		Criterion
	0	1	2	3	4	0	1	
<i>In the past 12 months:</i>								
1. I find that when I start eating certain foods, I end up eating much more than planned.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Substance taken in larger amount and for longer period than intended
2. I find myself continuing to consume certain foods even though I am no longer hungry.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Substance taken in larger amount and for longer period than intended
3. I eat to the point where I feel physically ill.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Substance taken in larger amount and for longer period than intended
4. Not eating certain types of food or cutting down on certain types of food is something I worry about.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Persistent desire or repeated unsuccessful attempt to quit
5. I spend a lot of time feeling sluggish or fatigued from overeating.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Much time/activity to obtain, use, recover
6. I find myself constantly eating certain foods throughout the day.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Much time/activity to obtain, use, recover
7. I find that when certain foods are not available, I will go out of my way to obtain them. For example, I will drive to the store to purchase certain foods	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Much time/activity to obtain, use, recover

**Table 2** (continued)

Item	Response categories					Scoring		Criterion
	0	1	2	3	4	0	1	
<i>In the past 12 months:</i>								
options available to me at home.								
8. There have been times when I consumed certain foods so often or in such large quantities that I started to eat food instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–1	2–4	Important social, occupational, or recreational activities given up or reduced
9. There have been times when I consumed certain foods so often or in such large quantities that I spent time dealing with negative feelings from overeating instead of working, spending time with my family or friends, or engaging in other important activities or recreational activities I enjoy.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Important social, occupational, or recreational activities given up or reduced
10. There have been times when I avoided professional or social situations where certain foods were available, because I was afraid I would overeat.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–1	2–4	Important social, occupational, or recreational activities given up or reduced
11. There have been times when I avoided professional or social situations because I was not able to consume certain foods there.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–1	2–4	Important social, occupational, or recreational activities given up or reduced
12. I have had withdrawal symptoms such as agitation, anxiety, or other physical symptoms when I cut down or stopped eating certain foods. (Please do NOT include withdrawal symptoms caused by cutting down on caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Withdrawal symptoms
13. I have consumed certain foods to prevent feelings of anxiety, agitation, or other physical symptoms that were developing. (Please do NOT include consumption of caffeinated beverages such as soda pop, coffee, tea, energy drinks, etc.)	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Withdrawal symptoms
14. I have found that I have elevated desire for or urges	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Withdrawal symptoms



## Appendix B

**Table 3** Items and scoring of the modified Yale Food Addiction Scale

Item	Response categories					Scoring		Criterion
	0	1	2	3	4	0	1	
<i>In the past 12 months:</i>								
1. I find myself consuming certain foods even though I am no longer hungry.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Substance taken in larger amount and for longer period than intended
2. I worry about cutting down on certain foods.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–3	4	Persistent desire or repeated unsuccessful attempt to quit
3. I feel sluggish or fatigued from overeating.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Much time/activity to obtain, use, recover
4. I have spent time dealing with negative feelings from overeating certain foods, instead of spending time in important activities such as time with family, friends, work, or recreation.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Important social, occupational, or recreational activities given up or reduced
5. I have had physical withdrawal symptoms such as agitation and anxiety when I cut down on certain foods. (Do NOT include caffeinated drinks: coffee, tea, cola, energy drinks, etc.)	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Withdrawal symptoms
6. I kept consuming the same types or amounts of food despite significant emotional and/or physical problems related to my eating.	no	yes	–	–	–	0	1	Use continues despite knowledge of adverse consequences
7. Eating the same amount of food does not reduce negative emotions or increase pleasurable feelings the way it used to.	no	yes	–	–	–	0	1	Tolerance
8. My behavior with respect to food and eating causes significant distress.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Use causes clinically significant impairment or distress
9. I experience significant problems in my ability to function effectively (daily routine, job/school, social activities, family activities, health difficulties) because of food and eating.	never	once a month	2–4 times a month	2–3 times a week	4 or more times or daily	0–2	3–4	Use causes clinically significant impairment or distress

*Notes.* If at least one question of each criterion is scored as one, then this criterion is met. A continuous symptom count can be calculated by adding up the criteria met (except impairment/distress). That is, the symptom count can range between zero and seven symptoms. A dichotomous score can also be calculated. Food addiction can be ‘diagnosed’ when at least three symptoms *and* the criterion of a clinically significant impairment or distress is met.

## Appendix C

**Table 4** Items and scoring of the Yale Food Addiction Scale for children

Item	Response categories					Scoring		Criterion
	0	1	2	3	4	0	1	
<i>In the last year (past 12 months):</i>								
1. When I start eating, I find it hard to stop.	never	rarely	sometimes	very often	always	0–2	3–4	Substance taken in larger amount and for longer period than intended
2. I eat food even when I am not hungry.	never	rarely	sometimes	very often	always	0–3	4	Substance taken in larger amount and for longer period than intended
3. I eat until my stomach hurts or I feel sick.	never	rarely	sometimes	very often	always	0–2	3–4	Substance taken in larger amount and for longer period than intended
4. I worry about eating too much food.	never	rarely	sometimes	very often	always	0–3	4	Persistent desire or repeated unsuccessful attempt to quit
5. I feel tired a lot because I eat too much.	never	rarely	sometimes	very often	always	0–2	3–4	Much time/activity to obtain, use, recover
6. I eat food all day long.	never	rarely	sometimes	very often	always	0–3	4	Much time/activity to obtain, use, recover
7. If I cannot find a food I want, I will try hard to get it (ex. ask a friend to get it for me, find a vending machine, sneak food when people aren't looking).	never	rarely	sometimes	very often	always	0–2	3–4	Much time/activity to obtain, use, recover
8. I eat food rather than do other things I like (ex. play, hang out with friends).	never	rarely	sometimes	very often	always	0–2	3–4	Important social, occupational, or recreational activities given up or reduced
9. I eat so much that I feel bad afterwards. I feel so bad that I do not do things I like (ex. play, hang out with friends).	never	rarely	sometimes	very often	always	0–2	3–4	Important social, occupational, or recreational activities given up or reduced
10. I avoid places that have a lot of food, because I might eat too much.	never	rarely	sometimes	very often	always	0–2	3–4	Important social, occupational, or recreational activities given up or reduced
11. I avoid places where I cannot eat the food I want.	never	rarely	sometimes	very often	always	0–1	2–4	Important social, occupational, or recreational activities given up or reduced
12. When I do not eat certain foods, I feel upset or sick.	never	rarely	sometimes	very often	always	0–2	3–4	Withdrawal symptoms
13. I eat certain foods to stop from feeling upset or sick.	never	rarely	sometimes	very often	always	0–2	3–4	Withdrawal symptoms
14. When I cut down or stop eating certain foods, I crave them a lot more.	never	rarely	sometimes	very often	always	0–2	3–4	Withdrawal symptoms
15. The way I eat makes me really unhappy.	never	rarely	sometimes	very often	always	0–2	3–4	Use causes clinically significant impairment or distress
16. The way I eat causes me problems. (ex. problems at school, with my parents, with my friends).	never	rarely	sometimes	very often	always	0–2	3–4	Use causes clinically significant impairment or distress
17. I want to cut down or stop eating certain foods.	never	rarely	sometimes	very often	always	0–3	4	Persistent desire or repeated unsuccessful attempt to quit
18. How often do you try to cut down on certain foods?	never	rarely	sometimes	very often	always	0–3	4	Persistent desire or repeated unsuccessful attempt to quit
19. The way I eat has made me feel sad, nervous, or guilty.	no	yes	–	–	–	–	–	(primer)
20. The way I eat has made me unhealthy.	no	yes	–	–	–	–	–	(primer)

**Table 4** (continued)

Item	Response categories					Scoring		Criterion
	0	1	2	3	4	0	1	
<i>In the last year (past 12 months):</i>								
21. I eat in the same way even though it is causing problems.	no	yes	–	–	–	0	1	Use continues despite knowledge of adverse consequences
22. I need to eat more to get the good feelings I want. (ex. feel happy, calm, relaxed)	no	yes	–	–	–	0	1	Tolerance
23. When I eat the same amount of food, I do not feel good the way I used to. (ex. feel happy, calm, relaxed)	no	yes	–	–	–	0	1	Tolerance
24. I try to cut down or stop eating certain foods.	no	yes	–	–	–	–	–	(primer)
25. I am able to cut down on certain foods.	no	yes	–	–	–	1	0	Persistent desire or repeated unsuccessful attempt to quit

*Notes.* If at least one question of each criterion is scored as one, then this criterion is met. A continuous symptom count can be calculated by adding up the criteria met (except impairment/distress). That is, the symptom count can range between zero and seven symptoms. A dichotomous score can also be calculated. Food addiction can be ‘diagnosed’ when at least three symptoms *and* the criterion of a clinically significant impairment or distress is met

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