



‘Food addiction’ – addictive-like eating behavior

The current state of research with the Yale Food Addiction Scale

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The construct of ‘food addiction’ is increasingly a subject of focus both in public discussion and in scientific research. The concept of ‘food addiction’ postulates a link between food intake and addiction. The aim of this article is to give nutrition experts a brief overview of the current scientific discussion, to provide an initial introduction to the complex topic of ‘food addiction’, and to explain the possible clinical applications of the “Yale Food Addiction Scale” questionnaire (YFAS 2.0).

Abstract

There are three methodical research approaches that are used to investigate the construct of a ‚food addiction‘: animal studies, neurocognitive human studies using imaging methods, and questionnaire-based human studies using the Yale Food Addiction Scale (YFAS). The focus of this article will be the current state of research using the YFAS 2.0. Based on the diagnostic criteria for substance addiction set forth in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the YFAS assesses and evaluates the psychological aspects of human eating behavior in a standardized manner to determine whether an individual may have an addiction. When ‚food addiction‘ is defined in this way, its prevalence in sample populations is 5–10%. Higher prevalence is observed in patients who are obese, have a binge eating disorder or bulimia nervosa, or who are underweight. Currently, research is being conducted into links between ‚food addiction‘, pathological eating behavior, personality traits (e.g. cognitive control of eating behavior, impulsiveness), and depression. However, the construct of ‚food addiction‘ that is under consideration here is also the subject of criticism because there are still many research gaps that need to be filled in: for example with regard to distinctions and terminology, and with regard to neural and behavioral correlates, and their effects on stigmatization, prevention and therapy.

Keywords: food addiction, addictive-like eating behavior, YFAS, obesity, eating disorder

Introduction

Terms like binge eating disorder, ‚food addiction‘ (e.g. „chocoholic“ [1]) and addictive-like eating behavior occur more frequently in German media. These terms link the absolutely crucial food intake with an addiction, as is typical in the case of the consumption of drugs. However, the term „addiction“ is often used and understood differently in everyday language than it is in

scientific literature [2, 3]. In everyday English, „ism“ or „holic“ suffixes are used synonymously with „addiction“ in the sense of an „extreme desire“ or an „abnormal reaction“ [2] in combination with an active „seeking“ for the thing desired [2]. Other examples of everyday terms using such suffixes include shopaholic, workaholic, etc. The word „addicted“ is also used in this sense, not necessarily meaning a real medical condition, e.g. „I’m addicted to chocolate (chocoholic [1])“.

However, the scientific definition of addiction is much more specific. In DSM-5 (Diagnostic and Statistical Manual of Mental Disorders version 5) [5] „addiction“ is classified under the overarching term „addiction and related disorders“ and comes under the umbrella of substance use disorders. The term „substance use disorders“ includes both substance abuse and substance dependence (according to DSM-IV [4]) [5]. ‚Food

addiction‘ is not included in DSM-5, however within specialist circles, it is being discussed as a new aspect of addiction/eating disorders. The purpose of this article is to provide an overview of the discussion as it now stands, and in particular, to provide an overview that is based on the use of the Yale Food Addiction Scale for diagnostics (see „Approaches“ section).

The numerous ways in which the term ‚food addiction‘ has been translated into other languages and the various connotations of these different translations illustrate the fact that this phenomenon remains poorly defined. It may be for this very reason that in German scientific literature, the original English term ‚food addiction‘ that was originally proposed by RANDOLPH in 1956 is still being used frequently [6]. Five decades after the term was coined, efforts began to discuss addictive-like eating behavior as a possible explanation for the globally increasing prevalence of obesity. This caused the number of publications on ‚food addiction‘ to increase rapidly [7, 8]. A comprehensive monograph with the title „Food and Addiction: A Comprehensive Handbook“ [9] was published in 2012.

Approaches

In research, there are three different approaches to the construct of ‚food addiction‘: neurocognitive human studies, animal studies, and questionnaire-based studies.

For the first of these approaches, imaging procedures are used, along with measurement of the hormones and peptides that regulate hunger and satiety, and which are components of the central reward system [10–13]. The main systems at work here are the mesolimbic dopamine system and the cannabinoid and opioid systems [14].

The second approach is animal studies. In these studies, after intermittent deprivation of food and sugar, reactions comparable to the

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reactions after drug consumption were observed in the test animals [15–17]. In special experimental setups, energy-dense, highly processed foods also triggered reactions in humans similar to those described in association with drug abuse (especially loss of control) [12,14,16,18], although significant differences (e.g. no endangerment of others/drug-related crime, no withdrawal symptoms, no sustained dose increases/tolerance development) were reported. In addition, most people do not consume such foods to a pathological extent, and are therefore not “addicted” to them, despite regular consumption [19].

The third scientific approach to ‘food addiction’ in humans is questionnaire-based studies designed to find overlaps in associated human behaviors. In order to detect ‘food addiction’ in a scientifically valid manner, US researchers developed a questionnaire [20] in 2009, which analyzes addictive-like eating behavior on the basis of the DSM diagnostic criteria for substance dependency [4]. This questionnaire-based method, known as the Yale Food Addiction Scale (YFAS), is already in its second edition, which was published in 2016, and is now known as the Yale Food Addiction Scale 2.0 (YFAS 2.0) [21]. The current version is based on the fifth edition of the DSM (DSM-5) [5]. The YFAS has been translated into several languages [22–25]. There is a German version by MEULE et al. [26]. This self-assessment questionnaire, which has 35 items and an eight-step response scale with options ranging from “never” to “every day”, asks questions to determine whether the eleven criteria of substance use disorders according to DSM-5 are met in the context of food intake. These are described in ♦ Table 1 and example items are given. The eleven criteria used are also used in DSM-5 for the diagnosis of the more commonly known substance use disorders such as alcohol dependency, cannabis dependency, or gambling addiction. They check all the most relevant categories: loss of control, social impairment, use

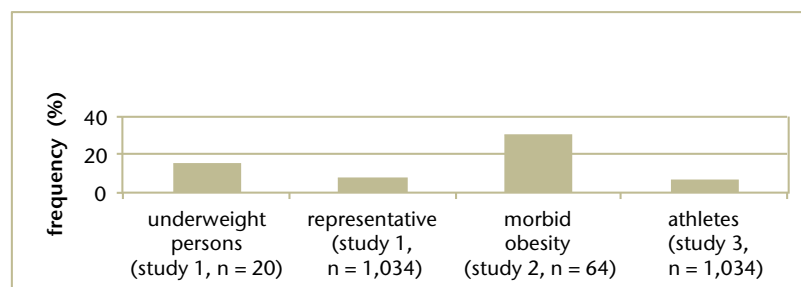


Fig. 1: Prevalence of ‘food addiction’ assessed by YFAS 2.0 in three different German samples [own data from (29, 31) and own unpublished data]
YFAS = Yale Food Addiction Scale

that endangers oneself and others, and pharmacological aspects [5]. When two symptoms occur within 12 months along with clinically significant impairment, the criteria for a substance use disorder are considered to be met. In addition, the severity is classified according to three severity grades: mild (2–3 criteria met), moderate (4–5 criteria met) and severe (≥ 6 criteria met) [5]. YFAS 2.0 attempts to transpose the classical criteria for addiction onto human eating behavior in order to detect potentially addictive-like eating behavior in a manner analogous to the technique used for substance use disorders. If this clinically significant impairment is present along with at least two symptoms, ‘food addiction’ is “diagnosed” according to YFAS 2.0 [20]. In the current version of the YFAS (version 2.0), the behavioral aspect of ‘food addiction’ is captured and there is no assessment of the foods that are consumed in such situations. Some authors argue that the concept of a ‘food addiction’ relates specifically to highly processed foods [27], which is why sometimes the term ‘processed food addiction’ is used (see below) [28].

At this point in time, ‘food addiction’ should be viewed as a scientific suggestion / a scientific construct. It is not an officially recognized diagnosis according to DSM-5. However, due to the standardized YFAS, research into this topic area can be compared on an international level for the first time.

Studies using the Yale Food Addiction Scale

In a systematic review of studies conducted up to July 2014 using the previous version of the YFAS (version 1.0), an average ‘food addiction’ prevalence of 19.9% was determined [29]. Here, all English-language studies that measured a YFAS 1.0 diagnosis or symptom score were included, resulting in a sample of nearly 200,000 people who were predominantly female and 60% of whom were either overweight or obese. Prevalence was higher in women than in men, was higher in people who were overweight/obese than in those of normal weight, and was higher in persons over 35 years of age than in younger people [29]. Studies in students and in population samples showed lower prevalence rates of 5–10% [30]. Higher rates of prevalence of 15–25% were observed in studies in obese people. The prevalence in sample populations of patients with morbid obesity (body mass index [BMI] ≥ 35 kg/m²), binge eating disorder (BED), or bulimia nervosa (BN) was even higher [30]. The most frequently mentioned individual symptom was “unsuccessful attempts to cut down on/control eating”, which affected almost 100% of obese people. The prevalence of the other symptom manifestations varied significantly between the different study populations [30].

In a population-representative study, the prevalence of ‘food addiction’ in Germany was 7.9% according to YFAS 2.0 [31] (♦ Figure 1, study 1). For comparison: according to the World Health

Organization (WHO) (2014), the prevalence of alcohol abuse in Europe is 7.5%, and the prevalence in Germany is 5.4% [32]. The proportion of persons with 'food addiction' in the underweight group was 15% (♦ Figure 1, study 1). In a sample of subjects with grade 2 or 3 morbid obesity (mean BMI = 46 kg/m²) at a German university hospital, the prevalence of 'food addiction' according to YFAS 2.0 was 29.7%, and prevalence among those with grade 3 obesity was even higher at 35.3% [33] (♦ Figure 1, study 2). Another study conducted in German athletes (inclusion criterion: at least 4 hrs/week of exercise and usually actively in participating in competitions) a 'food addiction' prevalence of 6.3% was determined according to the YFAS 2.0 (own unpublished data, ♦ Figure 1, study 3).



If the person in question is not experiencing any suffering, no diagnosis can be made, regardless of the number of symptoms that are reported. In such cases, no diagnosis of substance use disorder can be made according to DSM-5, and neither can a "diagnosis" of 'food addiction' be made according to YFAS 2.0.

Manifestation of the YFAS symptoms

One of the most commonly reported symptoms across all three study populations was "eating more than planned or for longer than planned" (19.2%, 40.6%, 19.7%). In study 2, the symptom "unsuccessful attempts to cut down on/control eating" was also commonly reported, which lines up with the previous study results [30]. Both of these symptoms indicate that the person in question is having difficulty controlling their food intake.

According to FINLAYSON and DALTON [34], in an everyday environment where highly processed foods that are energy dense and optimized for maximum sensory enjoyment are constantly available and ever present, control of appetite and individual susceptibility to disorders can play a key role in the regulation (or dysregulation) of food intake. A distinction is made between two different systems here: a homeostatic system (hunger, satiety) and a hedonic system (further categorized into taste preferences = liking, and needs = wanting). In the above studies, it was precisely this aspect of controlling eating behavior that

the subjects described as problematic (♦ Table 1: Manifestation of symptoms). The hedonic system may be involved in weight gain processes and in the development of eating disorders. When this system becomes dysregulated, there is a risk of overconsumption. Possible links with 'food addiction' are discussed in "Hedonics of Food Consumption" [34]. However, the pleasure of eating is also an important component of quality of life [34], and in the opinion of the authors, this should not be forgotten even when considering potential problems to do with the hedonic system.

Studies that have already been conducted show that in people with morbid obesity, the symptom known as "sufferings" (clinically speaking this means significant impairment) was common, with a rate of 35.9%. This criterion plus the manifestation of at least two symptoms form the minimum criteria for substance use disorder ("substance related and addictive disorder" diagnosis) according to DSM-5, and thus also for a "diagnosis" of 'food addiction' according to YFAS

2.0. This means that if the person in question is not experiencing any mental distress, no diagnosis can be made, regardless of the number of symptoms that are reported. Therefore, the probability of a 'food addiction' diagnosis is correspondingly higher in persons who do experience mental distress/sufferings which means that, particularly among the morbidly obese, the probability is much higher than for those of normal weight.

One symptom that seldom manifested in any of the three samples was "development of tolerance" (7.4%, 17.2%, 5.3%), and this was also demonstrated in other studies [35]. At the time, this group of researchers suspected that an age-related effect was at work here because it is possible that tolerance only develops after several years of addictive-like eating behavior [35]. The sample populations in question were still relatively young, with average ages of: 41 (study 1), 45 (study 2), and 36 (study 3). It remains unclear whether the development of tolerance plays any role in eating behavior, and if it does, to what extent.

Diagnostic criterion according to DSM-5 [5]	example item from [26]	1. Frequency within a representative German sample (%) [29]	2. Frequency within a sample of morbidly obese persons (%) [31]	3. Frequency within a sample of athletes (%) [own unpublished data]
consuming large amounts or consuming for longer than planned (amount)	I found that when I started eating certain foods, I ended up eating much more than planned.	19.2	40.6	19.7
unsuccessful attempts to cut down on/control food intake (attempts)	I thought a lot about cutting down on certain kinds of food, but I still ate them.	15.6	42.2	12.5
large amount of time taken up (time spent)	I spent a lot of time feeling sluggish or fatigued from overeating.	11.6	23.4	6.3
craving	I had such a strong desire to eat certain foods that I could no longer think about anything else.	11.0	20.3	6.6
failing to meet obligations (obligation)	I did not perform well at work or at school because I ate too much.	17.3	23.4	6.6
substance use despite social/personal problems (problems)	My friends or family were worried about how frequently I overate.	18.3	25.0	8.6
activities given up	I consumed certain foods so often or in such large quantities that I gave up other important things. Such things may include working, or spending time with family or friends.	18.9	12.5	7.1
impairment/distress	My eating behavior caused me great distress.	8.5	35.9	7.6
substance use in physically hazardous situations	I kept consuming certain foods even though I knew that it was physically dangerous. For example, I continued to eat sweets even though I have diabetes, or I continued to eat fatty foods even though I have heart disease.	18.3	28.1	2.0
substance use despite physical/emotional consequences (consequences)	I kept consuming the same types of food or the same amount of food even though my eating behavior was causing emotional and/or physical problems.	12.7	42.2	6.2
development of tolerance (tolerance)	I found that eating the same amount of food did not bring me the same level of enjoyment as it did before.	7.4	17.2	5.3
withdrawal symptoms (withdrawal)	I felt irritated, nervous, or sad when I cut down on or stopped eating certain foods.	18.5	25.0	12.0
YFAS 2.0 Food Addiction		7.9	29.7	6.3
YFAS symptom score (mean value, SD, measuring range)		1.69 (SD = 2.8; 0–11)	3.00 (SD = 2.9; 0–11)	0.93 (SD = 2.0; 0–11)

Tab. 1: **Diagnostic criteria according to DSM-5, sample items from YFAS 2.0, and frequency of symptoms in different German samples**

Bold print = values mentioned in text

DSM = Diagnostic and Statistical Manual of Mental Disorders; SD = standard deviation; YFAS = Yale Food Addiction Scale

Links between 'food addiction' and other disorders

A number of research groups are currently discussing parallels between 'food addiction' and obesity, but also between 'food addiction' and eating disorders such as BED or BN [19, 34]. In studies in patients who have BED or BN, very similar levels of 'food addiction' prevalence have been found [22, 33, 35, 36]. Individuals who had BED additionally experienced cravings for sweet things [37], loss of control with regard to food, and feelings of guilt after bingeing [38]. The YFAS 2.0 is also used to determine parameters such as cravings, loss of control, and distress, which could mean significant overlaps between 'food addiction' according to YFAS 2.0 and corresponding eating disorders.

This calls into question what the additional benefit of YFAS 2.0 would be. However, DAVIS argues that BED (the most common eating disorder) should be considered separately from 'food addiction' because although there are similarities between the two conditions (compulsive overeating), there are also some important differences. According to DAVIS, addictive diseases are self-sustaining clinical phenomena, and possibly also acquired diseases of the brain [40], whereas BED belongs to the category of psycho-behavioral diseases [39]. Not all BED patients meet the criteria for 'food addiction', and the same is true vice versa. Patients who do not have BED, but who do have a 'food addiction' according to YFAS 2.0 might also exhibit grazing behavior – i.e. continuous food intake in small portions and not in the form of episodic binges involving large amounts of food. The two forms of consumption, episodic and continuous, are also found in other addictive diseases (e.g. alcoholism) [39].

According to current research results, various personality traits can also influence eating habits. The focus here is on impulsiveness, depression, cognitive control, and ex-

treme craving attacks [31, 43, 44]. It was found that obese people and those with BED exhibited elevated levels of food-related impulsive behavior [45, 46]. DAVIS et al. observed higher levels of manifestation of impulsiveness, addictive personality traits, and cravings among people with 'food addiction' and BED [8] than in those who did not have 'food addiction' or BED. MEULE and colleagues also demonstrated [43] that there is a link between some aspects of impulsiveness and addictive-like eating behavior in obese people. Pathological eating behavior was observed particularly in obese people who were in a negative mood [47]. In addition, among the morbidly obese patient group prior to or after bariatric surgery, depression was the most common mental illness [48]. Based on this, SCHAG et al. concluded that impulsiveness, depression, and pathological eating behavior are closely related [44].

In a separate study, the total score for rigid control (control of food intake without leaving room for deviations in behavior), measured by using the extended German version of the Three Factor Eating Questionnaire, the "erweiterter Fragebogen zum Essverhalten" [extended questionnaire on eating behavior] (FEV+) [49–51], was successfully used as an indicator to predict the number of symptoms of 'food addiction' [33]. Individuals who exhibited restrictive eating behavior also manifested higher levels of wanting compared to those who did not restrict their food intake, whereas liking was

manifested to a similar extent across both groups. Based on this, VEENSTRA and DE JONG [52] concluded that wanting, and thus also automatic approach tendencies, play a more important role in eating behavior than simple taste preferences. Likewise, the number of 'food addiction' symptoms was successfully used as an indicator to predict both the sum of the scores for mental quality of life as measured by the short-form (36) health questionnaire (SF-36) [53, 54], and the number of extreme craving attack symptoms according to DSM-5 [5] [33].

◆ Figure 2 outlines the described relationships between rigid control, impulsiveness, depression, extreme craving attacks, restriction, and eating disorders/'food addiction'.

Criticism of the concept of 'food addiction'

The construct of 'food addiction' itself, as described here, has been the subject of criticism [55–57]. Some of the aspects that are criticized include that there is no universally acknowledged definition of the term [55, 58], and that the results are partially based on animal studies in a context of extreme hunger and that the applicability of findings from such studies to humans is questionable [59]. The YFAS/YFAS 2.0 questionnaire instrument itself is also criticized because it is not clear what exactly the YFAS/YFAS 2.0 measures. In addition, only one

Glossary

craving = a strong urge or desire to consume a food (or drug) [5]

grazing = repeating episodes of consumption of small quantities of food over a long period, with the feeling of loss of control [41]

wanting = need, appetite; involves the appetite center, the stimulus and the motivation to eat something [42]

liking = preference, inclination; involves the concept of pleasure and taste [42]

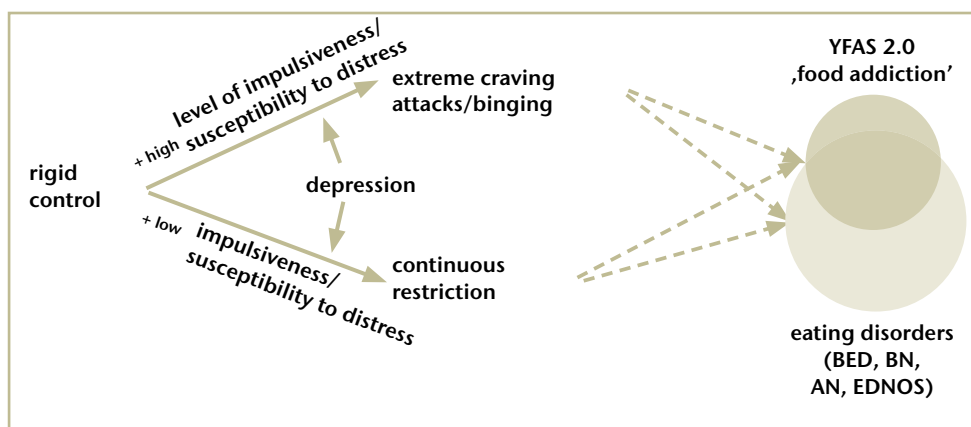


Fig. 2: Postulated link between individual behavioral traits, eating disorders, and 'food addiction' (mod. according to [33])

AN = anorexia nervosa; BED = binge eating disorder; BN = bulimia nervosa;
 EDNOS = eating disorder not otherwise specified; YFAS = Yale Food Addiction Scale

in six obese people meet the criteria for 'food addiction', along with a certain percentage people of normal weight and a comparatively high proportion of those who are underweight, as well as those who exhibit binge eating behavior [60]. The working group of ALBAYRAK and HEBBRAND has also discussed whether 'food addiction' is a substance-based addiction, or rather a behavioral addiction [61–63]. In addition, many of the clinically significant eating disorder-related problems can be explained and treated without the need to apply an additional addiction concept. Indeed, making these problems synonymous with addictive disorders could even cause further pathologies, instead of helping to cure them [59, 60, 64].

However, scientists who support the 'food addiction' concept argue that the findings from animal models are comparable to human behaviors in the context of eating disorders [58, 65] and the heterogeneity of the results is due to differences in the stimuli and not due to discrepancies at the neural level [66]. In their article "Clearing the confusion around processed food addiction" [28], IFLAND and colleagues argue that at the very least, further research should be conducted into food addiction, despite all of the criticism. They themselves suggest that the

concept of 'food addiction' should be more precisely termed 'processed food addiction' because it is primarily based on the addictive use of highly processed products which are not considered to be necessary for survival, but which may cause non-transmissible diseases (e.g. obesity or type 2 diabetes) [28]. They argue that humans must eat for survival and that eating cannot be simply avoided as in the case of the consumption of other substances (e.g. alcohol) according to the abstinence principle. However, this essential food intake could be achieved entirely without the use of highly processed, energy-dense products, which lead to addictive symptoms as per the 'processed food addiction' model. From this, IFLAND and colleagues conclude that 'processed food addiction' should be taken seriously, and that public campaigns aimed at limiting the availability of highly processed and energy-dense foods should be launched in order to successfully effect change as was previously achieved with campaigns against alcohol and tobacco [28]. However, there have been no studies on the feasibility or benefits of such campaigns.

Another separate issue is that the 'food addiction' construct may contribute to a reduction in stigmatization, as found by LATNER et al. in

a study. Trial subjects stigmatized obese people less when they were told about 'food addiction' beforehand [67].

Conclusions

'Food Addiction' suggests that there is a proximity between everyday food intake and addiction in the sense of disorders or diseases. Unlike recognized addictive substances such as cocaine or alcohol, a healthy body is absolutely dependent on a sufficient intake of energy and nutrients, as these are vital for survival. 'Food addiction' in the sense of a general substance consumption disorder would thus pathologize a basic human need. For this reason, the question of whether the term 'food addiction' should be changed to 'processed food addiction' is currently being discussed. The YFAS does not allow any conclusions to be drawn with regard to any substance-related aspects because the current version 2.0 only records behavioral aspects, and not the food-stuffs consumed in the respective situations. It is indisputable that there are people within the population whose eating behaviors cause them distress, and that such eating behaviors must be considered pathological. These behaviors include the eating disorders anorexia nervosa, BN and BED, which are already recognized in DSM-5. It is possible that food addiction, as determined by YFAS 2.0, is another additional independent eating disorder that is particularly close to behavioral addiction: A behavior that is in fact physiologically necessary (in this case, eating) is misused by those affected by the condition in a pathological manner in order to force positive feelings (similar to gambling addiction, shopping addiction, or sex addiction). In light of the fact that 'food addiction' according to YFAS 2.0 overlaps to a large extent with the diagnoses of BN and BED and possibly also anorexia nervosa, it is clear that more research into

the distinctions between these conditions is needed. It is questionable whether 'food addiction' actually occurs and has clinical significance among groups who have no concomitant eating disorders. According to the current state of knowledge, a 'food addiction' diagnosis using YFAS 2.0 can often be considered an aspect of classical eating disorders (♦ Figure 2). Rigid control strategies for food intake that leave no room for deviations in behavior appear to be typical of both classical eating disorders and 'food addiction' (♦ Figure 2). It is possible that both 'food addiction', according to YFAS 2.0, and eating disorders could be prevented using flexible control strategies that leave room for deviations in behavior such as occasional overshooting of basic set limits.

In humans, YFAS research has provided the first findings on pathological eating behavior. However, more research is still needed in order to establish a new DSM-5 diagnosis. What is needed is more precise analyses, universally recognized definitions of terms, and studies with hard endpoints. Furthermore, the effects that a new 'food addiction' diagnosis could have on prevention and treatment, public health, stigmatization and the individual's situation, remains unclear. For this reason, the clinical use of the YFAS 2.0 for "diagnosis" of 'food addiction' cannot yet be recommended. The questionnaire should (for the time being) continue to be considered a purely scientific instrument that cannot be used as evidence to reach conclusions with regard to preventative measures or treatment.

Conflict of Interest

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