Obesity Research & Clinical Practice 15 (2021) 191–204

Contents lists available at ScienceDirect

Obesity Research & Clinical Practice

journal homepage: www.elsevier.com/locate/orcp

Review

Prevalence and correlates of food addiction: Systematic review of studies with the YFAS 2.0

Jônatas Oliveira[a,b,*], Maíra Stivaleti Colombarolli[c], Táki Athanássios Cordás[a,b,d]

[a] Eating Disorders Program (AMBULIM/PROTAD), Institute of Psychiatry, University of São Paulo, São Paulo, Brazil
[b] School of Medicine, University of São Paulo, São Paulo, Brazil
[c] Faculty of Philosophy, Science and Letters of Ribeirão Preto, University of São Paulo, Brazil
[d] Institute of Psychology, University of São Paulo, São Paulo, Brazil

ARTICLE INFO

Article history:
Received 8 May 2020
Received in revised form 19 March 2021
Accepted 28 March 2021

Keywords:
Food addiction
Eating disorders
Obesity
Eating attitudes
Yale Food Addiction Scale 2.0

ABSTRACT

Background: Research on food addiction (FA) has been growing and increasing interest has been seen in comprehending its mechanisms and clinical and psychological correlates of this phenomena. This field of study is specially apply to understand obesity and eating behavior issues related to eating disorders (ED).
Objectives: We performed a literature review that describe recent research using the updated version of the Yale Food Addiction Scale (YFAS 2.0) or modified-YFAS (mYFAS 2.0), from the date of its publication.
Methods: Search were performed in Web of Science, Pubmed and PsycNET databases for studies that used the YFAS 2.0 and mYFAS 2.0.
Results: The studies (n = 53) investigated adaptation and validation of the scale in different cultures (n = 13), prevalence on nonclinical populations and representative samples (n = 5), food addiction in obesity samples (n = 11), in samples with ED and disordered eating (n = 10) and studies that investigated FA in association with other clinical and psychological variables (n = 14).
Discussion: Studies with the YFAS 2.0 reveal higher prevalence of FA in different samples, and a great association between FA and BED, BN and obesity. Implications for diagnostic of this phenomena and the overlap between FA and other disorders are discussed.
Conclusions: The field of FA remains an open subject and effort must be implied to understand the subjective experience of addiction related to eating and food.

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* Corresponding author at: Eating Disorders Program (AMBULIM/PROTAD), Institute of Psychiatry, University of São Paulo, São Paulo, Brazil.
E-mail address: oliveira.jonatas@usp.br (J. Oliveira).

https://doi.org/10.1016/j.orcp.2021.03.014
1871-403X/

Introduction

Consumption of certain foods despite its negative consequences, intense food cravings and experience loss of control over eating brings eating behavior closer to the concept of drug addiction. Based on this idea, a research field was developed to study the phenomenon named as food addiction (FA). Much of the effort and research in this field is due to the concern with the growth of obesity, in addition to altered ways of eating, as in the case of disordered eating and eating disorders (ED) [1]. The first definition of FA was described by Theron Randolph in 1956: "A specific adaptation of one or more foods regularly consumed, which in a very sensitive person, produce a pattern of symptoms similar to other additive processes" [2,3].

The field of substance-related and addictive disorders (SRADs) represents one of the most stigmatized fields in mental health [4]. Individuals who suffer from substance use disorders often experience impairment in the ability to make decisions and reduced cognitive control in different levels, which are the focus of the intervention in this kind of disorders [2]. In the new updated version of the Diagnostic and Statistics Manual of Mental Disorders (DSM-5 [5]), the term 'addiction' was removed from the diagnostic classification because of its potentially negative meaning and its vague definition.

Neurochemical bases for the common effects of food and substances, regarding the performance of areas involved in pleasure, reward, stress response, memory and decision making, have been studied. Shared responses and symptoms reinforce the idea of FA in animal models, with evidence of these processes also in humans [6].

The Yale Food Addiction Scale (YFAS) was initially published in 2009 to assess FA according to the DSM, 4th Edition text revision substance use disorders (SUD) criteria [7]. The scale adapted the seven criteria for SUD applying it to FA, thus producing a continuous symptom count scoring method.

The new version of DSM-5, including the changing of the name of this category from SUD to SRADs, motivated thus an updating in the assessment of FA and maintenance of its theoretical coherence with the diagnostic criteria, resulting in the YFAS 2.0 [8]. Specifically, the new scale accounted for the change from seven to 12 symptoms to diagnose SRAD: (1) Consumed more than planned, (2) Unable to cut down or stop, (3) Great deal of time spent, (4) Important activities given up, (5) Use despite physical/emotional consequences, (6) Tolerance, (7) Withdrawal, (8) Craving, (9) Failure in role obligation, (10) Use despite interpersonal/social consequences, (11) Use in physically hazardous situations and (12) Impairment or distress. Also, the YFAS 2.0 includes two scoring options: (1) a continuous symptom count that reflects the number of diagnostic criteria met by the participant and (2) a diagnosis of FA based on the number of symptoms and clinically significant impairment or distress [8]. Diagnostic threshold can be met by reporting three or more symptoms plus clinically significant impairment or distress, which is a less exigent than previously required [8,9].

A reduced version of YFAS 2.0 was also developed and validated (mYFAS 2.0), to follow the updated criteria and provide a brief version with thirteen items to be used as screening for FA [9]. In the first study that described development of the scale, the authors demonstrated appropriate reliability (Kuder–Richardson's $\alpha = 0.92$). Prevalence rates varied from 10.0% at the original YFAS to 15.8% with YFAS 2.0 due to the smaller threshold of symptoms to diagnose FA, which was reduced to three according to the new criteria.

The existence of the diagnosis of FA is still on debate. Part of it lies in the fact that it derives from a proposed clinical condition assessed by self-report measure, and flaws in the proposition of a construct model of this type of addiction [10–12].

Aims

Considering controversial debates on the development and measure of FA, and its varying prevalence rates among different samples, we aim to perform a systematic review of the studies assessing FA with YFAS 2.0. Specifically, we aim to investigate factors associated with the prevalence of FA, as measured by this scale.

Methods

Data search and selection

A search was performed in the Web of Science, Pubmed and PsycNET databases, according to Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) [13]. The search was performed using the terms "Yale Food Addiction Scale 2.0" and "Food Addiction", comprising peer-reviewed articles that used the second version of the Yale Food Addiction Scale (YFAS 2.0).

Initially, 156 articles were identified, and after removing duplicates (n = 86), 70 articles had their abstract screened to identify including criteria: use of the YFAS 2.0 or mYFAS 2.0 scale in adult samples. Some studies that did not use the scale (n = 3), studies that used the first version published in 2009 (n = 3) and that used the version for children (n = 2) or studies conducted whit adolescents (n = 2) were excluded. After this step, 60 studies had their full-text screened. Studies that did not use YFAS 2.0 for assessment of FA (n = 5), a dissertation (n = 1) and clinical protocols (n = 2) were further removed from the sample. Finally, 52 studies had their data extracted and full text analyzed and discussed (Fig. 1).

Data extraction

Study authors, year of publication, sample description, mean samples' body mass index (BMI) and prevalence of FA were extracted from studies, together with its main findings. After reviewing the data, we categorized studies according to a shared framework regarding their purpose and type of samples used. Discussion of data on FA in these different groups of studies was then made in light of current evidence.

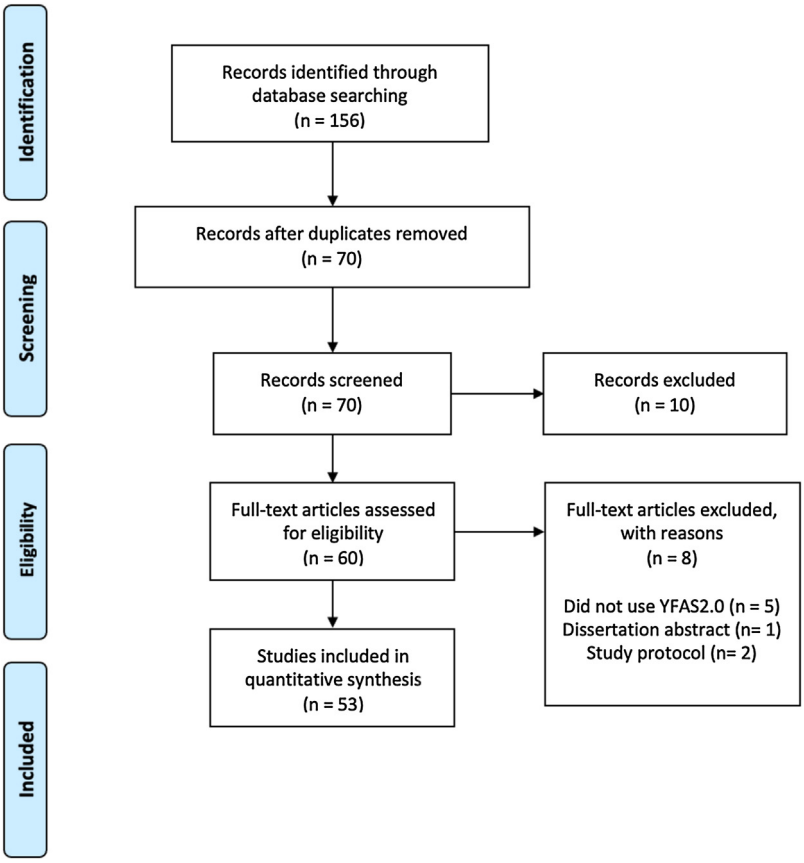

Fig. 1. Study selection flow diagram, presented according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) statement.

Results

After inclusion criteria were applied to search results, 52 eligible papers (53 studies) were selected and had their full-text analyzed. After extraction of the data, categories emerged based on studies main purpose and type of samples in which FA was investigated. Table 1 present these results and categories of study themes. Five categories of relevant content of the studies with FA are described, namely: (1) cultural adaptation and validation of YFAS 2.0 and mYFAS 2.0 (n = 14); (2) prevalence in nonclinical, population-representative samples (n = 5); (3) FA in samples with obesity (n = 11); (4) FA in samples with ED or disordered eating (n = 10); and (5) studies that investigated FA in association with other clinical and psychological variables (n = 13). After inclusion criteria were applied to search results, 52 eligible papers were selected and had their full-text analyzed. After extraction of the data, categories emerged based on studies main purpose and type of samples in which FA was investigated.

Cultural adaptation and validation studies

The original version of the scale, published by Gearhardt et al. [8], and its short-version, mYFAS 2.0, developed by Schulte and Gearhardt [9], were adapted and validated across different contexts, with translations in Brazilian Portuguese [14,15] German [16,17] Arab, [18], Japanese [19], Italian [20,21], French [22,23], and Malay [24].

New YFAS 2.0 showed improved psychometric properties when compared to original version, with most indices of fit demonstrating good fit on de Confirmatory Factor Analysis (CFA) for the one-factor model of FA (CFI = 0.958; TLI = 0.974; RMSEA = 0.108). The mYFAS 2.0 performed similarly on indexes of reliability and convergent. Further investigations on its psychometric properties were later performed, with investigation of structure invariance across black and white samples, men and women which identified that items describing symptoms related to physical effects of excessive eating had a poor association with the single-factor FA for women, but not for men, suggesting that other cultural factors might mediate this association in female samples, such as aesthetic pressure, diet culture, and weight cycling [25]. Additional evidence of fit of unifactorial structure were reported for both versions, in studies with French, German, Japanese and Brazilian samples (Alpha varying from 0.83 to .90; CFI from 0.904 to .988; RMSEA from 0.02 to .065) but not for the Malay sample [14–17,22].

Convergent and discriminant validity between FA and other phenomena were conducted in different studies. Scores of YFAS 2.0 were shown to be related with binge-eating, anxiety, depressive symptoms and emotion dysregulation [9,20,21,26]. Scores on eating concern, weight concern, and shape concern, emotional eating and cognitive restraint and impulsivity were also associated with YFAS [14–17,19,23,27].

Validation of YFAS 2.0 in clinical samples revealed that the items more frequently endorsed by severe obesity sample (YFAS 2.0 version) was item 3 ("I ate to the point where I felt physically ill") and item 32 ("I tried and failed to cut down on or stop eating certain foods"). A strong association between FA, BED, and obesity was a possible cause for the results [26]. In bariatric population, Clark et al. [28] reported relationship between FA and all factors of the Emotional Eating Scale (EES): anger/frustration, anxiety and depression. After controlling for EES scores, FA accounted for significant variance in history of binge eating. Brunault et al. [23] also reported association of FA and BED in bariatric population. Additionaly, they found that the reduced version underestimated FA prevalence and

Table 1
Summary of findings of studies that assessed FA with the YFAS 2.0 and mYFAS 2.0.

Authors, year of publication	YFAS version; Aims	Sample (n); %F	BMI Mean (SD)	Prevalence of FA	Main findings
Adaptation and cultural validation studies					
Gearhardt, 2016 (Study 1)	YFAS 2.0; Development of the and evidence of convergent, discriminant and incremental validity.	MTurk (536); 54.1%	26.67 (6.76)	14.6%	Good internal consistency, as well as convergent, discriminant, and incremental validity. Elevated scores were associated with higher rates of obesity and more severe pathological eating (e.g., binge eating).
Carr, 2016	mYFAS 2.0; Measurement invariance across White and Black samples, also men and women.	Undergraduate students (642); 66.5%	25.33 (5.51)	18.8%	mYFAS 2.0 tests very similar constructs for White and Black people and mostly similar constructs for men and women.
Aloi, 2017	YFAS 2.0; Validation of the Italian version.	Students (574); 57%	22.5 (3.9)	3.4%	Single factor structure emerged at the CFA (alpha coefficient was 0.87). Severity level successfully discriminated the severity of binge eating, depressive symptoms, and sleep quality index.
Brunault, 2017	YFAS 2.0; Validation of the French version.	Students and their families (330); 80.3%	23.3 (4.9)	8.2%	Good internal consistency (Kuder-Richardson alpha = 0.83). YFAS was associated with BMI, binge eating, uncontrolled and emotional eating, binge eating disorder, and cognitive restraint. FA predicted BMI above and beyond binge eating frequency.
Meule, 2017	YFAS 2.0; Validation of the German version.	University students (455); 89%	22.32 (3.65)	10%	FA diagnosis was associated with higher body mass, binge eating frequency, trait food craving, and attentional impulsivity as well as with lower perceived self-regulatory success in dieting.
Schulte, 2017	mYFAS 2.0; Development.	MTurk (213)	26.67 (6.76)	13.1%	Both scales performed similarly on indexes of reliability, convergent validity with related constructs (e.g. weight cycling), discriminant validity with distinct measures (e.g. dietary restraint) and incremental validity evidenced by associations with frequency of binge eating beyond a measure of disinhibited eating.
Fawzi, 2018	YFAS 2.0; Validation of the Arabic version.	Egyptian medical students fluent in English and Arabic (236)	22.3 (4.1)	11%	The 3-week intraclass correlation coefficients for diagnosis and symptom scores were 0.95 and 0.93, respectively (Cronbach's alpha was 0.89).
Nunes-Neto, 2018	mYFAS 2.0; Validation of the Brazilian version.	Brazilian participants (7693)	N/A	4.32%	Adequate psychometric properties and adequate internal consistency reliability (Cronbach's alpha = 0.89). A single factor solution yielded the best goodness-of-fit parameters for both the continuous and categorical version in CFA.
Khine, 2019	YFAS 2.0; Validation of the Japanese Version.	Undergraduate students (731); 78.5%	16.0−18.4: 17.1%; 18.5−24.9: 79.1%; ≥25.0: 3.7%	3.3%	High uncontrolled eating and emotional eating scores of Three-Factor Eating Questionnaire, a high Kessler Psychological Distress Scale score, frequent desire to overeat, and frequent snacking were associated with FA presence.
Clark, 2019	YFAS 2.0; Validation in bariatric population	Pre-bariatric patients (314); 82.8%	46.96 (8.16)	23.7%	Those meeting the criteria for FA were more likely to have a history of binge eating, and FA was related to all factors of the Emotional Eating Scale: anger/frustration; anxiety; and depression.
Swarna Nantha, 2020	YFAS 2.0; Validation of Malay version.	Patients from a regional primary-care clinic (358); 67.6%	30.54 (2.25)	5.0%	A two-factor structure of the YFAS was confirmed as the most optimal solution for the scale via CFA. In both its diagnostic and symptom count version, the measure had good internal consistency.
Manzoni, 2020	YFAS 2.0; To examine the structural validity, measurement invariance, reliability of the Italian version.	Non-clinical population (304); Inpatients with severe Obesity (400)	N/A	3.6 % (Non-clinical); 24% (Obesity)	An CFA confirmed the structure for both the hierarchical structure and the first-order structure. Internal consistencies were shown to be acceptable. Test–retest reliability statistics revealed good results.

Brunault, 2020	mYFAS 2.0; Comparing the psychometric properties of the mYFAS 2.0 versus the full YFAS 2.0 and validate the French version.	Non-clinical population (250); 80%	22.8 (2.7)	6.4% (mYFAS 2.0) 7.6% (YFAS 2.0)	Scale had good convergent validity with the YFAS 2.0, BMI, binge eating, cognitive restraint, uncontrolled eating and emotional eating.
	To determine psychometric properties, and to compare the full YFAS 2.0 and the mYFAS 2.0 in terms of FA prevalence and symptoms in both populations.	Patients with Obesity (345); 75.7%	44.5 (7.0)	Québec: 14.3% Reims: 20.7%; Tours: 21.7%	The mYFAS 2.0 had good convergent validity with the YFAS 2.0, binge eating, depression, but not BMI. In patients with obesity and seeking surgical treatment, the mYFAS 2.0, underestimated the FA prevalence and number of FA symptoms.
Prevalence in nonclinical, population representative samples					
Hauck, 2017	YFAS 2.0; Investigate the prevalence of FA in a representative sample.	German representative sample (1034); 49%	26.7	7.9%	Underweight (15.0%) and obese (17.2%) individuals exhibited the highest prevalence rate of FA. There is a non-linear relationship between addictive-like eating and BMI, with the highest prevalence among underweight and obese persons.
Schulte, 2018	YFAS 2.0; Investigate the prevalence of FA.	United States representative sample (986); 48.8%	27.53 (7.38)	45.65% (Underweight); 12.16% (Normal weight); 10% (Overweight); 19.26% (Obese)	FA prevalence was higher in persons who were underweight or obese, relative to normal weight or overweight. FA was associated with higher BMI in women and persons who were older, white and/or reported lower income.
Carr, 2020	mYFAS 2.0; Information about the utility in different gender and racial/ethnic groups.	United States representative sample (923); 50.6%	27.75 (7.51)	15.2%	Results supported full and partial measurement invariance across racial and gender groups, respectively. Observed differences in prevalence rates, like higher rates of FA in women and Hispanic individuals, likely due to true differences in the population rather than due to measurement bias.
Horsager, 2020	YFAS 2.0; Estimate the prevalence in the adult general population of Denmark, and verify psychometric proprieties.	Denmark individuals (n = 1436); 58.7%	N/A	9.0%	The CFA supported a one-factor model, and the scale had good internal consistency. The YFAS 2.0 score correlated with eating pathology including binge eating frequency, impulsivity and BMI. The most commonly criteria were "inability to cut down or stop" (16.0%) followed by "consumed more than planned" (13.2%).
Pipová, 2020	mYFAS 2.0; Prevalence of FA in Czech population.	Nationally representative non-clinical sample (1841); 51.2%	N/A	N/A	The youngest population (aged 15–19) had a significantly higher score for FA, than the older age groups. People living alone scored significantly higher than the married respondents. Respondents characterized by insecure attachment styles showed a higher FA score.
Obesity samples					
Meule, 2017	YFAS 2.0; To investigated impulsivity in severely obese individuals presenting for bariatric surgery.	Patients with obesity presenting for bariatric surgery (133); 77.4%	48.8 (7.08)	47.4%	Scores on attentional and motor impulsivity interactively predicted FA status: higher attentional impulsivity was associated with a higher likelihood of receiving a FA diagnosis only at high (+1 SD), but not at low (−1 SD) levels of motor impulsivity.
Benzerouk, 2018	mYFAS 2.0; The prevalence of the FA phenotype and its association with psychiatric disorders in bariatric surgery candidates.	Patients prior to bariatric surgery (128)	46.7 (7.0) (FA); 45.9 (6.5) (Non-FA)	25%	FA was significantly associated with higher prevalence of current mood and anxiety disorders and past mood disorders, higher current suicidality but not with ED. Also, FA was associated with higher emotional eating, and loss of control over consumption of foods high in fat, sugar and/or salt, but not of fruits, vegetables or grain products.
Guerrero Perez, 2018	YFAS 2.0; Analyze the prevalence of FA in patients with obesity seeking bariatric surgery and to examine whether FA could predict WL following dietary intervention before surgery.	Patients with obesity (110); 76.4%	46.0 (5.8)	26.4%	Those who met FA criteria showed less weight loss after dietetic intervention and regained weight during dietary intervention.

Table 1 (*Continued*)

Authors, year of publication	YFAS version; Aims	Sample (n); %F	BMI Mean (SD)	Prevalence of FA	Main findings
Müller, 2018	YFAS 2.0; Association between FA and other addictive behaviors.	Bariatric surgery candidates (216); 80.1%	48.30 (7.22)	23.7%	Moderate relationship of FA symptoms with buying disorder symptoms and a weak association with Internet-use disorder symptoms. None of the patients scored above the respective questionnaire thresholds for gambling disorder or exercise dependence.
Steward, 2018	YFAS 2.0; Assess the prevalence and severity level of FA in a sample of women with obesity and healthy controls and to explore the associations between neuropsychological performance, impulsivity traits.	Obesity (33); Control (36); 100%	21.3 (2.1) (Control); 42.4 (6.9) (Obesity)	24.2% (Obesity); 2.8% (Control)	In the obesity group, FA severity levels were negatively correlated with overall scores on the Iowa Gambling Task. Participants with obesity meeting criteria for FA committed more omissions and perseveration errors on the Conners' Continuous Performance Test vs. non-FA.
Brunault, 2019	YFAS 2.0; Association between childhood/adult ADHD and FA/binge eating in patients with obesity.	Patients with obesity (105); 86.7%	46.9 (7.8)	14.3%	Patients with adult ADHD were at significantly higher risk of FA than patients without adult ADHD (28.6% vs. 9.1%). Adult and childhood ADHD were significantly associated with self-reported FA, FA scores and binge eating scores.
Schulte, 2019	YFAS 2.0; Assess whether (a) foods differ in their associations with subjective experience indicators of abuse liability and (b) individual differences in subjective experiences and eating behavior emerge using YFAS 2.0	Overweight or obesity (44); 100%	33.68 (5.46)	38.6%	Highly processed foods were more associated with indicators of abuse liability, although individuals with FA reported decreased enjoyment for and intentions to consume highly processed foods. Subjective experiences were associated with greater consumption of highly processed foods for participants with FA.
Schulte, 2019	YFAS 2.0; To assess neural responses in individuals who meet the c̈linicalF̈A phenotype.	Overweight and obesity [FA (20), Non-FA (24)]; 100%	34.57 (5.10) (FA); 33.15 (5.81) (Non-FA)	45%	There was a significant interaction between participant group and neural response in the right superior frontal gyrus to highly versus minimally processed food cues. Women with FA exhibited modest, elevated responses in the superior frontal gyrus for highly processed food images and more robust, decreased activations for minimally processed food cues, whereas participants in the control group showed the opposite responses in this region.
Schulte, 2020	YFAS 2.0; Examine differences in questionnaires that assess behavioral characteristics of addictive disorders to assess whether a "diagnosis" of FA may reflect unique features within the context of overweight and obesity	Participants with overweight or obesity (46)	33.9 (5.5)	43%	Individuals with FA exhibited significantly higher scores on the Palatable Eating Motives Scale overall score and subscales for coping and enhancement of emotions, Dutch Eating Behavior Questionnaire, Emotional Eating subscale, Impulsivity Scale (negative urgency) and lack of perseverance subscales, and the Food Craving Inventory overall score and subscales of cravings for sweets and fast food fats.
Burrows, 2020	YFAS 2.0; YFAS 2.0; To determine the feasibility of a personality-targeted motivational interviewing intervention.	Participants with overweight or obesity [49; Intervention (24); Control group (25)]	36.4 (5.2) (Intervention); 26.9 (8.2) (Control)	80% in both groups	At three month follow up, there were significant reductions from baseline for both groups in total FA symptoms, but these changes were not significantly different between groups. At 3 months the intervention group significantly reduced their energy from non-core foods compared with control.
Clark-Sienkiewicz, 2020	YFAS 2.0; To evaluate differences in psychiatric symptoms and eating behaviors between White and Black patients pursuing bariatric surgery.	Patients prior to bariatric surgery (284); 82.8%	49.04 (9.47) (Black); 45.23 (6.62) (White)	N/A	White patients reported higher levels of eating in response to anger/frustration and eating in response to depression than Black patients. They also reported more symptoms of FA, a difference that was trending toward significance. No significant differences for anxiety or depression.

Eating disorders samples					
de Vries, 2016	YFAS 2.0; Prevalence and correlates of the in individuals with BN.	BN (115) Control (341)	26.1 (8.0) (BN); 23.1 (50) (Control)	96% (BN); 14% (Control)	A higher number of FA symptoms was associated with lower interoceptive awareness, higher depressiveness, and higher impulsivity in both groups. However, a higher number of FA symptoms was associated with higher BMI and weight suppression in controls only and not in participants with BN.
Carlson, 2018	YFAS 2.0; Association between lifetime nonsuicidal self-injury, emotion regulation and FA.	ED [(220; BED (36); BN (59); AN-R (24); AN-BP (19); OSFED-R (33); OSFED-BP (49)] Control (121); 100%	40.49 (11.05) (BED); 25.87 (5.24) (BN); 16.16 (1.42) (AN-R); 17.07 (1.05) (AN-BP); 19.21 (0.91) (OSFED-R); 26.21 (7.73) (OSFED-BP); 21.76 (4.16) (Control)	75.8% (ED); 4.1% (Control)	Similarly, subjects presenting FA showed a high prevalence of lifetime nonsuicidal self-injury, in both ED and controls (40.7% and 60.0%, respectively). FA and Difficulty in Emotion Regulation Scale total scores as indicators of the presence of lifetime nonsuicidal self-injury independent of group assignment, ED diagnosis, and age.
Granero, 2018	YFAS 2.0; Validate the YFAS 2.0 in a Spanish sample. To explore FA and it is clinical correlates in ED and gambling disorder (GD) patients.	ED (135); 89.6% GD (166); 7.2% Control (152); 81.6%	26.89 (10.17) (ED); 26.48 (4.38) (GD)	79.3% (BED); 95.3% (BN); 7.8% (GD); 3.3% (Control)	The prevalence of FA is heterogeneous between disorders. Common risk factors such as high levels of psychopathology and low self-directedness appear to be present in individuals with FA.
Linardon, 2019	YFAS 2.0; Examine the psychometric properties of the YFAS 2.0 and investigate the clinical significance of the FA construct.	BED symptomatology (220); 94.2%	25.95 (5.97)	42.3%	YFAS 2.0 scores contributed the largest percentage of unique variance in psychological distress and impairment over other BED features (overvaluation of weight and shape, binge eating, BMI).
Carter, 2019	YFAS 2.0; Determine whether FA scores would predict unique variance in the severity of ED psychopathology in BED.	BED (71); 93% Woman) Control (79); 84%	37.7 (9.6) (BED); 26.6 (5.8) (Control)	92% (BED); 6% (Control)	BED participants who met criteria for moderate/severe FA reported significantly higher ED psychopathology (except dietary restraint) as well as higher levels of anxiety and depression than BED participants with no/mild FA.
Jiménez-Murcia, 2019	YFAS 2.0; Provide a better phenotypic characterization of the FA construct by conducting a clustering analysis of FA in both conditions (ED and Obesity).	BN (119), BED (50), OSFED (49), Obesity (16); 100%	BN (22.7% with BMI > 30); BED (84% with BMI > 30); OSFED (4.1 with BMI > 30)	100%	Three clusters of FA participants were identified. Cluster 1 (dysfunctional): high prevalence of OSFED and BN, the highest ED severity and psychopathology, and more dysfunctional personality traits. Cluster 2 (moderate): high prevalence of BN and BED and moderate levels of ED psychopathology. Cluster 3 (adaptive): high prevalence of obesity and BED, low levels of ED psychopathology, and more functional personality traits.
Hauck, 2020	YFAS 2.0; Prevalence and potential relationships among FA, ED and exercise dependence in endurance athletes.	German endurance athletes (1022); 56.4%	22.83 (3.06)	6.2%	The association between FA and exercise dependence is stronger than between ED and exercise dependence, indicating FA as a potentially more relevant subject for prevention or therapy in people with exercise dependence.
Tran, 2020	YFAS 2.0; Investigate prevalence of FA diagnostic and its association with markers of severity in individuals with AN.	AN (33); 97.2%	16.5 (2.3)	47% [5.9%: mild FA, 32.4%: moderate FA; 61.7%: severe FA]	FA was significantly associated and positively correlated with the binge-eating/purging subtype of AN, higher levels of depression, anxiety and greater eating psychopathology. FA was not associated with level of impulsivity nor leptin and IGF-1 blood levels.
Bou Khalil, 2020	YFAS 2.0; To test whether FA mediate the relationship between the presence of a history of childhood maltreatment and ED severity.	ED [231 (FA: 154, Non-FA: 77)	20.97 (FA); 17.8 (Non-FA)	66%	FA participants reported higher scores on all five Child Trauma Questionnaire subscales. Using mediation analysis, significant indirect pathways between all Child Trauma Questionnaire subscales and the ED Inventory-2 total score emerged via FA, with the largest indirect effect emerging for physical neglect, followed by emotional abuse.
El Archi, 2020	YFAS 2.0; To investigated the factors associated with food craving in individuals at risk for ED.	AN (28), BN (19), BED (29); 95%	16.94 (1.31) (AN); 24.60 (6.89) (BN); 27.89 (8.71) (BED)	46.4% (AN); 94.7% (BN); 65.5% (BED)	Individuals at risk for BED or BN had higher food craving than those at risk for AN. Food craving was associated with BMI only for BED. Food craving was positively correlated with external eating in all groups, and with emotional eating in the AN and BED groups and correlated with anxiety only in BN.

Table 1 (*Continued*)

Authors, year of publication	YFAS version; Aims	Sample (n); %F	BMI Mean (SD)	Prevalence of FA	Main findings
FA in association with other clinical and psychological variables					
Gearhardt, 2016 (Study 2)	YFAS 2.0; To compare the original version of YFAS and the new YFAS2.0	MTurk (209); 61.2%	28.03 (7.31)	15.8%	Both versions of the YFAS were similarly associated with elevated body mass index, binge eating, and weight cycling. However, exceeding the FA threshold was more strongly associated with obesity for the YFAS 2.0 than the original YFAS.
Burrows, 2017	YFAS 2.0; Investigate FA and how it is associated with dietary intake, personality traits and mental health issues.	Australian participants (1344); 75.7%	27.7 (9.5)	22.2%	Predictors of severe FA were female gender and higher levels of soft drink and anxiety sensitivity. Overall people with "severe" or extremely severe depressive symptoms had the highest odds of having severe FA. The only variable that reduced the odds of having severe FA was vegetable intake.
Saab, 2017	YFAS 2.0; Identify the potential role of FA in the development of metabolic complications in the post-liver transplant population.	Liver transplant recipientes (236); 41.10%	26.8	5.1%	FA was not predictive of metabolic complications within this population. Nevertheless, we found that this population was at high risk of demonstrating symptoms of food misuse, and they were not likely to appreciate the risks of pathologic patterns of eating.
Li, 2018	YFAS 2.0; Investigate the relationship between FA with physical activity and sleep behavior	Australian participants (1344); 75.7%	25.9 (Non-FA); 32.2 (FA)	22% [0.7% "mild" 2.6% "moderate" 18.9% "severe" FA]	FA individuals had significantly less physical activity and reported significantly more symptoms of poorer-quality sleep (more likely to snore, more likely to have fallen asleep while driving, reported more days of daytime falling asleep) compared to non-FA individuals.
Meule, 2017	YFAS 2.0; To determine sensitivity and specificity of scores on the Food Cravings Questionnaire-Trait-reduced for discriminating between individuals with and without FA.	FA (43), Non-FA (389); 88.4%	22.3 (3.70)	9.9%	A cut-off score of 50 on the Food Cravings Questionnaire-Trait-reduced discriminated between individuals with and without FA with high sensitivity (85%) and specificity (93%).
Nunes-Neto, 2018	mYFAS 2.0; To determine the prevalence of FA in a large Brazilian non-clinical sample, as well as sociodemographic and psychopathological correlates and its association with quality of life	Brazilian participants (7693); 71.3%	N/A	4.32%	FA was associated with a positive screen for a major depressive episode, bipolar spectrum disorder and skin picking disorder. FA was also independently associated with exposure to early life psychological and sexual abuse as well as with reduced physical, psychological, social, and environment quality of life.
Imperatori, 2018	YFAS 2.0; Exploring the association between FA symptoms and body uneasiness	Italian adults (395)	22.99 (3.64)	6.1%	Body uneasiness was independently associated with FA symptoms, even when controlling for the presence of other variables. FA symptoms were positively related to binge eating severity, body uneasiness and both depressive symptom and emotion dysregulation severity and BMI.
Lacroix, 2019	YFAS 2.0; How Brazilian men and women define and experience addictive-like eating	Psychiatric outpatients (15); 53.3%	35.43	66.7%	Thematic analysis of interviews identified emotional eating as the most frequent causal factor for FA. Consequences included emotional, interpersonal, occupational, and health-related impairments which appeared primarily related to weight gain, rather than to the pattern of addictive-like eating itself.

Paterson, 2019	YFAS 2.0; To determine how persons conceptualized their addictive-like eating.	Participants who identified themselves as FA (10)	23.7	60%	Themes identified in thematic analysis: (1) Social Environment, describing how past and present social environments affected addictive-like eating; (2) Situational Cues, encompassing situational contributions to addictive-like eating; (3) Persistent Cognitions, including preoccupation with food and loss of control; and (4) Impact of Weight, encompassing weight gain and its perceived impact on health, body image, and distress.
Skinner, 2019	YFAS 2.0; 1) to measure plasma oxytocin concentrations; 2) determine whether healthy vs. hyperpalatable visual food cues differentially altered plasma oxytocin; and 3) assess whether appetite hormone responses to healthy vs. hyperpalatable food images depended on weight or FA status.	Healthy (18)	25.64 (2.84) (Non-FA); 33.55 (6.02) (FA)	33%	A positive correlation between BMI and plasma oxytocin was found at baseline. Oxytocin levels were higher, and cholecystokinin levels lower in FA vs. non-FA. There were no significant changes in plasma oxytocin levels in response to either healthy or hyperpalatable food images.
Hauck, 2020	YFAS 2.0; To establish prevalence of FA, ED, exercise dependence, and predictors of FA in a population that is known to be at-risk for ED.	Amateur athletes (1022)	22.83 (3.06)	6.2%	A mediator effect of exercise dependence on the relationship between perfectionism and FA was found. Approximately 4% (positive)/6% (negative) of the variance in FA were accounted for by the mediator.
Lacroix, 2020	YFAS 2.0; To explore the association of self-reported FA with impairment in the domains of social, cognitive, and emotional functioning.	Students (365); 80.7% Nonclinical sample (544)	22.25 (3.42) (Students); 29.33 (8.83) (Nonclinical sample)	Students (10.1%); MTurk (22.6%)	FA scores showed large correlations with emotional, social and cognitive impairment in both samples, respectively. The most common difficulties endorsed were emotional (e.g., feeling ashamed or critical of oneself, upset, or worried due to one's eating habits), followed by social and cognitive.
Nicolau, 2020	YFAS 2.0; To analyze if there is any relationship between FA and clinical or psychological variables among patients with type 2 diabetes.	Patients with type 2 diabetes; 40%	33.41 (7.5) (FA); 31.6 (5.9) (Non-FA)	29.3%	Patients with FA had a greater BMI. The proportion of subjects with diabetic retinopathy, neuropathy and nephropathy was greater among patients with FA vs. Non-FA patients. The percentage of patients with FA with significant depressive symptoms was also greater.
Weideman, 2020	YFAS 2.0; To evaluate the clinical significance of the proposed three severity specifiers of the YFAS 2.0	MTurk (1854)	27.6 (6.9)	11.4%	The Non-FA group reported significantly lower levels of shape, weight and eating concerns, and global ED psychopathology and dietary restraint than mild and severe FA groups. The severe FA group reported higher food craving scores vs. Non-FA group.

Note: YFAS 2.0: Yale Food Addiction Scale; mYFAS 2.0: Modified Yale Food Addiction Scale; FA: Food Addiction; ED: Eating Disorder; MTurk: Participants were recruited using the Mechanical Turk; AN: Anorexia Nervosa; AN-R: Anorexia Nervosa Restrictive Subtype; AN-BP: Anorexia Nervosa Binge-Purging Subtype; BN: Bulimia Nervosa; BED: Binge Eating Disorder; OSFED: Otherwise Specified Feeding and Eating Disorder; GD: Gambling Disorder; ADHD: Attention Deficit and Hyperactive Disorder; HC: Healthy controls; CFA: Confirmatory factor analysis.

number of FA symptoms in these patients, when compared to the full version.

Studies of prevalence in nonclinical, representative samples

Studies were conducted to assess prevalence of FA in population-representative samples from the United States [29], German population [30], Denmark [31], and Czech population [32]. For nonclinical population, the prevalence of FA varied between 7.9% in Germany [30] and 15.2% in the US [33].

Schulte and Gearhardt [29] investigated the prevalence of FA in association with obesity and demographic factors in a US representative sample and found high prevalence of FA in people underweight (45.65%) and less prevalent in people with normal and overweight (12.16 and 10%, respectively). Higher FA was associated with age, BMI, being female, being white, and having lower income. Similarly, Hauck et al.'s [30] study also reported a higher prevalence of FA in people in underweight and obesity categories (15 and 17.2%, respectively) in German sample. In that sense, the authors suggest that the relation between FA and problematic eating behavior may accompany different phenotypes and may not be exclusively associated with obesity.

Food addiction in samples with obesity

Studies with populations with obesity and bariatric surgery candidates investigated neuropsychological and cognitive functioning in obesity associated with FA. Specifically, Steward et al. [34] compared presence of FA in individuals with obesity, and found that in the group with FA and obesity, the performance in the Iowa Gambling Task was lower (more omissions and perseveration errors), compared to the non-FA group. Conversely, Brunault et al. [27] reported that ADHD patients were at higher risk of presenting FA than those without. Schutle et al. [35,36], using neuroimaging assessment, found a significant interaction between activity in the superior frontal gyrus and the visualization of highly processed food images in participants with high FA scores. Association between the consume of high palatable foods and liability for abuse were also reported [35–38].

In the study by Brunault et al. [39], the most prevalent symptom reported in the YFAS 2.0 by patients applying for bariatric surgery was "persistent desire to control food consumption" (93.1%). Guerrero Perez et al. [40] also reported that the scores on YFAS 2.0 were predictors for poorer weight loss achievement after a dietary and lifestyle intervention before bariatric surgery. Meule et al. [16,17] found that attentional impulsivity scores on the Barratt-Impulsiveness Scale positively predicted FA in this population (47.4%). Similarly, Müller et al. [41] found an association between FA and other addictive behavior such as buying disorder symptoms. Likewise, Benzerouk et al. [42] found that FA was significantly associated with mood and anxiety disorders, and problematic eating behaviors. The association of emotional eating and psychopathology was also found by Clark-Sienkiewicz et al. [43] in a sample of black and white bariatric surgery candidates, in which eating in response to depressive symptoms was associated with FA in white, but not black individuals.

Food addiction in samples with eating disorders

Ten studies that assessed FA in samples with ED were included, in which the prevalence of FA was consistently higher than in other types of samples, as revealed on Table 1. In these samples, different associations with FA were described. In the study of Carlson et al. [44], FA and total scores on the Difficulties in Emotion Regulation Scale (DERS) were indicators of the presence of lifetime non-suicidal self-injury independent of group assignment, ED diagnosis, and age. In other study, clinically significant impairment or distress was found in 58% of the patients with AN. Most frequently FA criteria endorsed by the AN patients were "Continuing to use, even when it causes problems in relationships" (68%), "Giving up social, occupational or recreational activities" (63%), "Continued eating despite physical or psychological problems" (50%) and "Tolerance" (44%). Also, de Vries & Meule [45] reported that FA symptoms were associated with lower interoceptive awareness, higher depressiveness, and higher impulsivity in both Bulimia Nervosa (BN) and controls. FA severity was also associated with higher BMI and harm avoidance, and lower self-directedness across all EDs [46]. The study of Carter et al. [47] report that, after controlling for other clinical variables (BMI, depression and anxiety), FA scores positively predicted binge frequency, but not global ED psychopathology, in a BED group.

Jiménez-Murcia et al. [48] attempted to describe specific phenotypes of FA across ED and obesity, and identified three clusters of ED patients with FA: cluster 1, characterized by greater prevalence of BN and OSFED, severity of ED psychopathology and dysfunctional personality traits; cluster 2 included those with BN and BED that had moderate levels of ED psychopathology; cluster 3, also called adaptive type, was described as having more functional personality traits, great prevalence of obesity and BED and low levels of ED psychopathology.

Some studies investigated FA in samples with disordered eating without clinical diagnostic for ED. The Eating Disorder Examination Questionnaire (EDE-Q) was used to classify the sample as 'probable BED cases' in the study by Linardon and Messer [49], and found a prevalence of FA in this sample of 42.3%. El Archi et al. [50] investigated FA and food craving in a sample of patients with high risk for ED according to DSM-5 criteria, and found that FA prevalence were higher in the group at risk for BN than in the AN and BED. Hauck et al. [51,52] also investigated disordered eating and exercise dependence and its relationship with FA in a sample of German amateur endurance athletes and calculate the probability of a risk for FA evaluated with YFAS, reporting that each unit of BMI, percentage thoughts about food and exercise dependence represented higher risk for FA by 14.1%, 2.5% wand 15.3%, respectively. Finally, Bou Khalil et al. [53] conducted a mediation analysis that revealed significant indirect pathways from which childhood trauma related to physical neglect and emotional abuse, and were associated with scores in the eating disorder inventory (EDI) in individuals with FA.

Clinical and psychological factors associated with food addiction

Another group of studies assessed FA in specific clinical contexts and investigated its physical and psychological correlates. For instance, in Gearhardt et al.'s [8] validation study of YFAS 2.0, the association between scores of FA and other clinical variables were investigated in a nonclinical sample, revealing that FA was associated with BMI, binge eating and weight cycling. Similarly, Burrows et al. [54] and Li et al. [77] found that being female, consuming more soft drinks, presenting anxiety and depressive symptoms increased the risk for FA. Also, individuals with higher levels of FA reported less physical activity and poorer-quality sleep when comparing with non-FA individuals, have more shape, weight and eating concern and more global ED psychopathology [55]. In a large Brazilian nonclinical sample, FA was associated with depressive, bipolar and skin picking disorder, impaired physical and mental health, and lower quality of life [14,15]. Likewise, scores of FA were also associated with emotional, social and cognitive difficulties in Brazilian students [56].

In the study of Meule [57], scores on Food Craving Questionnaire-Trait-reduced discriminate between FA and non-FA participants, revealing a strict relationship between the self-report experience of food craving and FA. Lacroix et al. [58] reported that

lack of control was the key characteristic of experiencing FA, with emotional eating being the most frequent causal factor. Similar findings were found in a qualitative study of Paterson et al. [59], in which people that considered themselves as addicted for food reported preoccupation with losing control over eating, difficulties with social contexts and expose to food cues, as well as concerns with weight and body image.

Some studies investigated particular relationship between FA and clinical characteristics. For instance, Saab et al. [60] investigated liver-transplant patients, and verified that FA did not predicted risk for metabolic complications. In other study, women with FA presented great responsiveness in a region previously described to be associated with food cues, and their oxytocin levels were also higher compared with those without FA [61]. An investigation between FA, clinical and psychological variables in three hundred patients with type-2 diabetes also reported that patients with FA had greater BMI, retinopathy, neuropathy, nephropathy and depressive symptoms, when compared with those without FA [62].

Discussion

This review brought together 52 studies conducted with YFAS 2.0 since its publication, in 2016, in which an update of the original YFAS scale was made including changes in the DSM-5 criteria for SARDs. Great effort has been made to understand the phenomena of food addiction in the literature since the publication of the first version of YFAS in 2009. Studies with the new criteria to assess food-related addictive behaviors have been developed in order to better comprehend this complex phenomena in different cultural and clinical contexts. In our review, we presented studies of adaptation and validation of this measure in different populations, and also evidence regarding relationship between FA and BMI, disordered eating behaviors, psychological symptoms and other metabolic conditions. In light of the reported findings, we discuss the concept of FA and its measure, addiction to food in ED and obesity, and psychological and clinical correlates of FA.

Food addiction measures and prevalence across different cultural contexts

To our knowledge, this is the first study to systematically compile studies that assessed food addiction with the new version of the YFAS, thus considering the new criteria of substance abuse and related disorders of DSM-5. Adaptation and validation of the measure in different contexts just after 4 years of its first publication demonstrate the great interest of the scientific community in deepen the comprehension of food addiction and its correlates. Previous version of YFAS have been translated and adapted to multiple contexts such as Chinese [63], Italian [64] and French version [65]. Like the previous version, the new, updated version of the scale has also demonstrated adequate indexes of reliability and convergence validity [8,9,19,22].

Regarding the unifactorial structure of the construct, some inconsistency have been observed in studies that measured invariance across different groups, with possible differences between female and male experience of FA [25]. Additionally, the one-factor model was not able to reach good fitting indexes in the Malay sample, which might be result of cultural differences on perception of addictive-related eating behavior. Lawson et al. [78], point that some constructs related to FA, such as food craving, and binge eating, vary according to cultural contexts.

Prevalence of FA measured with YFAS 2.0 and mYFAS 2.0, rates were also highly heterogeneous across the different samples. Some reasons for these differences have been also observed with previous version of YFAS [79]. Again, one possible reason for this is its great relation with other problematic eating behaviors, probably leading to bias in interpreting the items of YFAS according to the subjective experience of addictive-like relationship with food, which might be influenced by cultural context [78].

Food addiction in ED and obesity

The study of food addiction is of special interest for understanding causes and treatment of obesity. Most of studies addressing FA in this population are focused on severe obesity in patients seeking bariatric surgery. In our review, prevalence among samples with obesity seem to diverge from those previously reported with older version of YFAS, in which prevalence of FA in samples with obesity varied from 15 to 25% and with individuals with morbid obesity seeking for bariatric surgery varied from 30 to 50% [66]. In patients with obesity, FA was associated to impaired cognitive functioning and impulse control, presence of psychiatric symptoms, poorer diet and more frequent episodes of emotional eating.

Similarly, in ED patients, prevalence rates of FA were consistently higher than those reported in nonclinical populations. This high prevalence has been discussed by Hauck et al. [51,52] and seems to be explained by a possible overlap between assessment items in YFAS and criteria for BN and BED, especially those addressing the feeling of loss of control and consequences of excessive eating. This is supported by previous evidence showing relationship between scores on YFAS 2.0 and binge eating episodes, where loss of control over eating is a key feature. For instance, a study showed that scores on the YFAS 2.0 positively predicted binge frequency, but not global eating disorder psychopathology, in a BED sample, after controlling for body mass index, depression and anxiety [49]. In nonclinical samples, these relationships were also found, where food addiction was similarly associated with elevated body mass index, binge eating, and weight cycling [8].

The idea that individuals with overweight and obesity are unable to control their weight is part of the stigma involving this population, and may have contributed to the frequent association between BED and food addiction [67]. In the area of substance-related and addictive disorders, the loss of control in limiting intake and consumption of high doses is considered a stage for intoxication, which presents harmful effects and, together with a specific vulnerability, can generate dependence [68]. This scientific framework was the basis for the idea that addiction might be developed from the contact with certain addictive foods, which was supported by animal models evidence revealing that the consumption of these foods is a "risk for dependence" [1,35,36]. However, previous meta-analysis failed to support the theory that food caused a deficiency in the reward system by decreasing the number of specific dopamine receptors, which is an important mechanism of substance addiction [69].

About that, the studies that reported presence of FA in AN patients, firstly described by Granero et al. [46], and later by Tran et al. [70], found a prevalence of FA in the restrictive-type subgroup of 69.2%, a subtype characterized by intense attempts to control hunger and eating. The evidence about the severity of FA in AN patients being mediated by the severity of binge-eating and purging behaviors also contradict the idea of objective overeating in scores of FA, and might be better explained the subjective feeling of loss of control and distress over eating.

Changing in YFAS 2.0 instructions is also an important variable that could influence the way AN patients respond to this measure. Specifically, the scale ask respondents to consider ingestion of specific types of foods (highly processed, sugary and fatty foods) in the past year [8]. The way the question is proposed might elicit judgment of these foods as "dangerous" or "forbidden" and thus, their responses on the scale might reflect more their moral rules about

food than their actual consumption [71]. To address this hypothesis, new research should collect data on food consumption and qualitative investigations on food judgement. Also, Hauck et al. [30] reported a great prevalence of FA in individuals underweight, which supports the idea that the feeling of loss of control is not necessarily linked to increased food consumption.

Clinical and psychological correlates of food addiction

The presence of psychopathology and clinical conditions were commonly associated with FA in the reviewed studies. Specifically, general eating psychopathology and psychiatric conditions such as mood disorders and anxiety were commonly associated to the presence and severity of FA symptoms. Obesity, binge eating and a lifetime history of weight cycling, and its associated metabolic complaints, such as type-2 diabetes, were also frequently found in people with high levels of FA [62].

The association of FA with common clinical manifestations of other ED are still a critical issue on the proposed diagnose of FA. For instance, patients with BED, BN and obesity might share a great number of comorbidities as those reported by individuals with severe levels of FA, such as emotional eating, loss of control, emotional distress, social distress and cognitive impairment [56].

Even when a clinical condition is not present, the subjective feeling of loss of control over food, fear of gaining weight and aesthetic pressure could reflect in high scores on self-reported FA [11,72]. In the YFAS instructions, the control issue is described as "People sometimes have difficulty controlling how much they eat of certain foods", and the individual is asked to tick "foods you have had difficulty with in the past year" [7]. Loss of control is often associated with cravings, diet, restricted food and long periods of fasting, and commonly misinterpreted as an addiction-like behavior, considering the similarity with the subjective experience of dependence. However, this perception can reveal more of a disturbed eating attitude, than a proper clinical condition [11,71–73].

As information about obesity on social media, and spread by health professionals, have consistently increased in the past decades, this propaganda might reflect into the fear of "getting fat", avoidance of certain foods and self-imposed restriction of foods that can be understood as "forbidden" and "addictive" even by normal-weight nonclinical population [10,72]. The social stigma of obesity might also explain the appeal of a cultural fight against "obesogenic" foods and might reflect the fear of general population to develop an addictive-like behavior in relation to food. An example of that is the findings reported by Paterson et al., [59], where addictive-like eating was related to "persistent cognitions, including preoccupation with food and loss of control"; and "impact of weight, encompassing weight gain and its perceived impact on health, body image, and distress".

Subjective and hedonic effects of the consumption of certain foods are undeniable, but evidence about its psychopharmacological responses of substance use, that is, pleasure, relief of dysphoria, anesthesia and the calming effects are still scarce to support that food effects fit into a dependency model [2,80,74–76].

Conclusions and future directions of the food addiction science

Our review have some limitations that should be outlined. First, we did not address quantitative relationship between variables and thus, have not measure the effect of those in the FA. Second, we did attain to one single measure of FA, and did not include other sources of information related to addictive-like eating behavior. Nonetheless, YFAS 2.0 is the most used measure of FA and have been validated into relevant contexts and diverse cultural backgrounds.

Future studies could use different approaches to understand and measure FA. For instance, research in the qualitative field, such as the use of narratives and interviews, is still scarce in the area, and could contribute to the understanding of subjective factors that influence the responses to the scale, such as eating attitudes and behaviors related to substance use and addictive disorders (control, loss of control, use for relief, relapses and intense desire). Also, addressing the great overlap between clinical and psychological manifestations of FA and EDs is important to understand how beliefs about food and specific symptoms of these disorders negatively influence the completion of the scale. Furthermore, the role of social stigma of obesity might also influence the interpretation of food as "obesogenic" and, in consequence, reinforce the idea that these have potential for addiction even by individuals that do not suffer from clinical impairment due to obesity or EDs. Despite all these notes, the line of research continues to grow and new evidence is important to comprehend the role of addictive behavior on eating disorders and obesity.

Role of funding sources

The first author declares financial support in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (Capes).

Contributors

First author was responsible for the conception of research and execution of data collection and discussion of data. Second author was responsible for result synthesis and content, format and grammar review of the manuscript. The third author was responsible for the conception of research and review of the manuscript. All authors approved the final version of the manuscript.

Ethical statement

This manuscript is a review of the literature and there is no need for ethical approval by a research committee.

Conflict of interest

The authors declare no conflicts of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.orcp.2021.03.014.

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