

# Eating disorders and food addiction in men with heroin use disorder: a controlled study

Fatih Canan<sup>1</sup> · Servet Karaca<sup>1</sup> · Suna Sogucak<sup>1</sup> · Omer Gecici<sup>1</sup> · Murat Kuloglu<sup>1</sup>

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## Abstract

**Purpose** We aimed to determine the prevalence estimates of binge eating disorder, bulimia nervosa, anorexia nervosa, and food addiction in men with heroin use disorder and a matched sample of control participants.

**Methods** A group of 100 men with heroin use disorder, consecutively admitted to a detoxification and therapy unit, were screened for DSM-5 eating disorders, along with a group of 100 male controls of similar age, education, and body mass index. The Yale Food Addiction Scale (YFAS), the Barratt Impulsivity Scale-version 11, and the Eating Attitudes Test were used for data collection. Patients were also evaluated for various aspects of heroin use disorder (e.g., craving) using the Addiction Profile Index.

**Results** Binge eating disorder that met DSM5 criteria was more prevalent in patients with heroin use disorder (21%) than in control subjects (8%) (odds ratio 3.1, 95% confidence interval 1.3–7.3;  $p < 0.01$ ). Food addiction based on the YFAS was also more common among men with heroin use disorder (28%) than among control participants (12%) (odds ratio 2.9, 95% confidence interval 1.4–6.1;  $p < 0.01$ ). A current food addiction was associated with more severe craving and having a history of suicide attempts in the patients.

**Conclusions** Co-occurring binge eating disorder and food addiction are highly frequent in men with heroin use disorder. Screening for binge eating disorder and food addiction in patients with substance use disorder is important,

as interventions may improve treatment outcome in this patient group.

**Keywords** Anorexia nervosa · Binge eating disorder · Bulimia nervosa · Eating disorders · Food addiction · Heroin use disorder

## Introduction

Obesity has become one of the most important public health problems worldwide [1]. Numerous factors, including overeating, have been held responsible for the occurrence of obesity [2]. One of the reasons for overeating is loss of control over food intake which resembles a behavioral pattern seen in alcohol or substance use disorders [3]. Consuming certain types of foods may activate similar brain mechanisms and cause rewarding effects as do drugs of abuse [4]. Genetic research has also provided support for similarities rather than differences between pathological overeating and substance addictions [5]. Although it is debatable whether food addiction is a true diagnosis, the concept of food addiction has gained popularity in medical and public health research over the past decade [6, 7]. Food addiction has many similar features with chemical addictions such as tolerance (taking higher calorie diets over time), withdrawal (irritability, headaches, and nausea in the absence of food with heavy sugar, high caloric content), cravings, and relapse [3, 8]. By now, only few attempts have been made to operationalize the diagnosis of food addiction [9].

Prior studies demonstrated an association between eating disorders (particularly bulimia nervosa and binge eating disorder) and substance use disorders [10–12]. Patients with substance use disorders have been shown to have high

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✉ Fatih Canan  
fatihcanan@gmail.com

<sup>1</sup> Department of Psychiatry, Akdeniz University School of Medicine, 07059 Antalya, Turkey

rates of co-occurring anorexia nervosa, bulimia nervosa, and binge eating disorder (BED) [13, 14]. A recent systematic review has shown that more than a quarter of patients with substance use disorders met criteria for lifetime eating disorders [15]. The National Comorbidity Survey-Replication found lifetime diagnosis of substance use disorders was associated with 2.2- to 3.4-fold risk of current anorexia nervosa, 4.6- to eightfold risk of current bulimia nervosa, and 2.1- to 4.9-fold risk of current binge eating disorder depending on the substance in use [16]. Patients with both a substance use disorder and eating disorders exhibit increased stimulant-use involvement and higher frequency of co-occurring psychiatric disorders than those with a substance use disorder without eating disorders [17, 18].

The vast majority of the studies investigating the prevalence and correlates of eating disorders in substance use disorders have particularly focused on women [19–22]. Studies evaluating both women and men reported higher rates of eating disorders in women with substance use disorder than in men with substance use disorders [17, 18, 23]. In a very large community survey ( $n=36,984$ ) [24], the one-year prevalence of substance dependence was associated with risk of eating disorders for women but not for men. However, a diagnosis of eating disorder was based on a nonspecific, self-report scale (i.e., Eating Attitudes Test) in this study. Moreover, to our knowledge, no studies have yet systematically examined rates of different types of eating disorders in patients with opioid use disorder, or the effects of a comorbid eating disorder on the phenomenology, course, or outcome of opioid use disorder.

Given the paucity of studies investigating eating disorders in men with substance use disorder and because men with eating disorders are frequently underdiagnosed and undertreated by many clinicians [25], we sought to examine the frequency and correlates of co-occurring current DSM-5-defined bulimia nervosa, anorexia nervosa, and BED in a sample of treatment-seeking men with substance use disorders versus a comparison sample of men without substance use disorders. We also aimed to evaluate the distribution of food addiction among these two samples.

## Methods

### Participants

From December 2015 to April 2016, 100 male heroin-dependent adults were recruited from the detoxification and therapy unit of the Akdeniz University Hospital, Antalya, Turkey. This center utilizes a 28- to 35-day day detoxification with buprenorphine/naloxone combined with up to 10 sessions of behavioral drug and risk counseling. All patients fulfilled DSM-5 criteria for opioid use disorder and

were positive on urine drug tests, which are employed routinely in the center. Heroin was the primary drug of abuse by all patients. One hundred control subjects without current or lifetime history of substance-related disorders other than tobacco use disorder were recruited from the same geographical area as the patients. Controls were recruited through personal contact and fliers. Heroin-dependent patients were excluded if they had any other substance use disorder (except tobacco use disorder) and if their urine drug screen was positive for any drug other than heroine. Exclusion criteria for all participants included a current diagnosis of psychosis, mania, mental retardation, current suicidal ideation, and major medical or neurological disease. Neither patients nor controls were excluded for moderate alcohol use (no more than 1–2 drinks per occasion, and no intoxication or heavy drinking in the past year) caffeine use, or tobacco use.

The study protocol is in accordance with the latest version of the Declaration of Helsinki, and it has been approved by the ethics committee of Akdeniz University School of Medicine (approval number: 234/07.10.2015). Every participant provided written informed consent prior to participation in the study.

The diagnosis of current (within the past three-to-six months) eating disorders (anorexia nervosa, bulimia nervosa, and BED) was made by two trained clinicians who carefully followed DSM-5 criteria. For the patients, the diagnostic assessments and administration of self-report measures were performed after opioid withdrawal symptoms had been dissipated (as ascertained by a score of 4 or less on the Clinical Opiate Withdrawal Scale) [26].

### Measures

#### *Addiction Profile Index (API)*

The API [27] is a Turkish self-report instrument assessing various aspects of alcohol and substance use disorders. It consists of 37 items and five subscales (dependency diagnosis, characteristics of substance use, craving, the effects of substance use on the user, and motivation to quit using substances). The API was found to be reliable among alcohol and/or substance abusers with a Cronbach's alpha coefficient of 0.89. This scale was administered only to the patients.

#### *Barratt Impulsivity Scale-version 11 (BIS-11)*

The BIS-11 [28] is a 30-item scale that is widely used as a trait measure of impulsivity. Higher scores indicate greater levels of impulsivity. Turkish version of the BIS-11 was found to be reliable among healthy students and patients

with psychiatric disorders (Cronbach's alpha coefficient: 0.78 and 0.81, respectively) [29].

#### *Yale Food Addiction Scale (YFAS)*

We used the YFAS [9] to measure food addiction construct. The YFAS is a self-report questionnaire consisting of 25 items based on the DSM-IV-TR substance dependence criteria and previous instruments that are used to evaluate behavioral addictions. DSM-IV-TR adapted seven criteria of food addiction covered in the YFAS are as follows: consuming food more than planned; being unable to cut down or stop eating behaviors; excessive amount of time on eating food; neglecting important activities to eat; eating despite negative consequences; and tolerance to food and withdrawal from not eating. The YFAS examines addictive eating behaviors during the past 12 months. The total score ranges from 0 (0 criteria of food addiction) to 7 (7 criteria of food addiction). The diagnosis of "food addiction" is made if the respondent endorses three or more criteria over the past 12 months. Additionally, these symptoms must cause significant impairment or significant distress for the individual (as assessed with two extra items). The Turkish version of the YFAS was found to be reliable among bariatric surgery patients with a Cronbach's alpha coefficient of 0.86 [30].

#### *Eating Attitudes Test (EAT)*

The EAT [31] is a 40-item self-report instrument widely used to assess attitudes and symptoms characteristic of eating disorders, specifically, anorexia nervosa, and bulimia nervosa. Higher scores on the EAT are associated with more severely disturbed eating behaviors and increased tendency toward development of an eating disorder. Savasir and Erol [32] conducted the validity and reliability study for the Turkish version of the EAT and revealed that it had acceptable psychometric properties.

#### **Statistical analysis**

We used IBM SPSS Statistics software version 20.0 (Armonk, New York, USA) to perform statistical analysis. Continuous variables (i.e., age, BMI, and scale scores) were checked for normal distribution with the Kolmogorov–Smirnov one-sample test for goodness of fit. None of the continuous variables were normally distributed; thus, the Mann–Whitney *U* test was used to assess between-group differences (i.e., patients vs controls and patients with vs without BED). Continuous variables are presented as the median and interquartile range (IQR). The  $\chi^2$  test was used to compare proportions between the groups. Odds ratios and corresponding confidence intervals were

calculated to measure the main effect of heroin use disorder on eating disorders and food addiction. Statistical significance was set at a *p* value of less than 0.05.

#### **Results**

Sociodemographic features in the patient and control groups are shown in Table 1. There was no significant difference in sociodemographic variables between patients and non-substance-using controls. The prevalence of smoking, however, was higher in patients than in controls. In addition, patients scored higher on The BIS-11 and the EAT than matched controls (Table 1). Moreover, compared to control participants, patients with heroin use disorder were more likely to have a history of suicide attempt (22 vs. 4%,  $\chi^2 = 14.324$ ,  $p < 0.001$ ), a criminal record (59 vs. 8%,  $\chi^2 = 58.377$ ,  $p < 0.001$ ), and a history of self-mutilation (46 vs. 6%,  $\chi^2 = 41.580$ ,  $p < 0.001$ ).

The proportion of patients with BED was higher in patients with heroin use disorder (21%) than in control participants (8%) ( $p < 0.01$ ). The diagnostic threshold for food addiction based on the YFAS was met by 28% of patients with HUD and 12% of controls ( $p < 0.01$ ) (Table 2). None of the participants from either of the study groups met DSM-5 diagnostic criteria for bulimia nervosa or anorexia nervosa. Among heroin addicts with food addiction, 39.3% also satisfied criteria for BED. In addition, 52.4% of patients with BED also met criteria for food addiction. None of the patients were previously diagnosed as having BED. Patients with food addiction were significantly more likely to have a diagnosis of BED than those without food addiction ( $\chi^2 = 7.838$ ;  $p = 0.005$ ). Similarly, among control subjects with food addiction, 33.3% also met DSM-5 diagnostic criteria for BED. The proportion of control participants with food addiction in those with BED was 50%. Control participants with food addiction were also significantly more likely than those without food addiction to have a diagnosis of BED ( $\chi^2 = 11.891$ ;  $p = 0.001$ ).

The relationships between the presence and absence of food addiction and selected demographic and historical illness variables are shown in Table 3. A current food addiction was associated with more severe craving and having a history of suicide attempts in men with heroin use disorder.

A diagnosis of BED was not associated with any particular demographic or clinical variable in the patient group (Table 4).

Univariate analyses showed that compared to control participants without food addiction, control participants with a current food addiction were younger and more likely to have a significantly higher median of BMI and significantly higher EAT total scores (Table 5). Furthermore, a diagnosis of BED was associated with higher BMI values

**Table 1** Sociodemographic characteristics of the patients and controls

Characteristics	Patients ( <i>n</i> = 100)	Controls ( <i>n</i> = 100)	<i>z</i> -score or $\chi^2$ value	<i>p</i> value
Age (years)*	25 (5)	24 (6)	−1.300	0.194
BMI (kg/m <sup>2</sup> )*	21.4 (3.1)	21.3 (3.25)		
BIS-11*	65.5 (8)	55.5(11.3)	−4.606	<0.001
EAT*	13 (11)	9 (5.3)	−1.952	0.051
BMI Categories**				
Underweight (<18.5 kg/m <sup>2</sup> )	2	0	3.894	0.273
Normal weight (18.5–25 kg/m <sup>2</sup> )	87	83		
Overweight (25–30 kg/m <sup>2</sup> )	7	13		
Obese (>30 kg/m <sup>2</sup> )	4	4		
Marital status**				
Single	78	77	0.306	0.858
Married	19	21		
Widowed	3	2		
Highest level of education**				
5 years	9	8	5.620	0.132
8 years	46	31		
11 years	36	51		
>11 years	9	10		
Working status**				
Currently employed	34	46	3.000	0.083
Currently non-employed	66	54		
Currently smoking**				
Yes	100	50	66.667	<0.001
No	0	50		

*BIS-11* Barratt Impulsivity Scale-version 11; *BMI* Body mass index; *EAT* Eating Attitudes Test

\*Median (IQR), Mann–Whitney *U* test; \*\*,  $\chi^2$  test

**Table 2** Frequency of DSM5 binge eating disorder and food addiction based on the Yale Food Addiction Scale among patients with heroin use disorder and matched controls

	Patients ( <i>n</i> = 100)	Controls ( <i>n</i> = 100)	$\chi^2$ value	Odds ratio (95% CI)	<i>p</i> value*
Food addiction (%)	28	12	6.816	2.9 (1.4 to 6.1)	0.005
Binge eating disorder (%)	21	8	8.000	3.1 (1.3 to 7.3)	0.009

\*For  $\chi^2$  tests

and higher total EAT and BIS-11 scores in the control group (Table 6).

## Discussion

This study examined the prevalence estimates of eating disorders and food addiction and their relationship with demographic and clinical outcomes, among men in treatment for heroin use disorder. We found that patients with heroin use disorder had higher rates of BED and food addiction when compared with non-substance-using individuals. Neither patients nor controls met DSM-5 diagnostic criteria for other eating disorders. Comorbidity with food addiction was associated with more severe craving scores and higher possibility of having a history of suicide attempts in patients with heroin use disorder. Conversely, comorbidity

with BED was not associated with any demographic or clinical outcome.

Binge eating disorder (BED) is characterized by excessive food intake in a discrete period of time and lack of control over eating. BED was moved from "Results" section (a location for conditions requiring additional research) into the main text and classified together with other eating disorders in the DSM-5 [33]. Although BED is classified under the section of feeding and eating disorders in the DSM-5, the criteria of BED closely match those used to describe substance-related and addictive disorders, including lack of control over eating, escalation of use, social consequences, and personal distress [34]. The concept of food addiction significantly overlaps with BED [35]. Imperatori et al. [36] have reported that approximately one-third of obese patients with food addiction met criteria for BED, while only 4.1% of those without food addiction had BED. In addition, 57% of obese patients with BED

**Table 3** Demographic and clinical features for 100 heroin-dependent patients with and without food addiction

Characteristics	Patients with food addiction ( <i>n</i> = 28)	Patients without food addiction ( <i>n</i> = 72)	<i>z</i> -score or $\chi^2$ value	<i>p</i> value	
Age (years)*	25 (2)	24.5 (7)	−0.143	0.887	
BMI (kg/m <sup>2</sup> )*	22.6 (2.6)	21.3 (3.4)	−1.541	0.147	
Average daily heroin dose (g/day)*	4 (3.5)	3.5 (3.8)	−0.304	0.761	
The age of heroin debut (years)*	17 (2.8)	18 (7)	−1.797	0.072	
BIS-11*	65.5 (22.8)	65.5 (18)	−1.164	0.245	
EAT*	13 (9.8)	13 (12)	−0.692	0.489	
Characteristics of substance use*	0.6 (1)	0.3 (1.1)	−1.725	0.085	
Dependency diagnosis*	11.5 (1)	11 (3)	−1.848	0.065	
Effects of substance use on the user*	16.5 (2.8)	17 (9)	−0.558	0.577	
Craving*	6 (3.5)	3 (3)	−3.096	0.002	
Motivation to quit using substances*	6 (0)	6 (0)	−1.507	0.132	
BMI categories**	Underweight (<18.5 kg/m <sup>2</sup> )	0	2 (2.8%)	6.245	0.100
	Normal weight (18.5–25 kg/m <sup>2</sup> )	22 (78.6%)	65 (90.2%)		
	Overweight (25–30 kg/m <sup>2</sup> )	3 (10.7%)	4 (5.6%)		
	Obese (>30 kg/m <sup>2</sup> )	3 (10.7%)	1 (1.4%)		
Self-mutilation**	Yes	12 (42.9%)	34 (47.2%)	0.155	0.694
	No	16 (57.1%)	38 (52.8%)		
History of suicide attempts**	Yes	11 (50%)	11 (15.3%)	6.771	0.009
	No	11 (50%)	61 (84.7%)		
Criminal record**	Yes	17 (60.7%)	42 (58.3%)	0.047	0.828
	No	11 (39.3%)	30 (41.7%)		
Route of heroin administration**	Smoked/chased	23 (81.5%)	50 (69.4%)	1.649	0.199
	Injected	5 (18.5%)	22 (30.6%)		

*BIS-11* Barratt Impulsivity Scale-version 11; *BMI* Body mass index; *EAT* Eating Attitudes Test

\*Median (IQR), Mann–Whitney *U* test; \*\**n* (%),  $\chi^2$  test

have been found to have comorbid food addiction [37]. Our study confirms previous findings showing that patients and controls with food addiction are more likely to have a diagnosis of BED than those without food addiction. These findings support the view that food addiction and BED are closely associated.

BED and food addiction have been shown to be commonly associated with elevated BMI [38]. In obese patients who seek weight control treatment, the prevalence of BED was reported to be as high as 42.8% [39]. In a community-based, epidemiological study [40], nearly 70% of 59 individuals with BED reported BMI of 30 and above (mean BMI: 34.1), showing a strong relationship between BED and high BMI levels. Moreover, Pedram et al. [41] have found that adults with food addiction were 11.7 (kg) heavier and 4.6 BMI units higher than those without food addiction. In contrast to earlier findings, among our patients, neither BED nor food addiction was associated with increased BMI levels. However, control participants with food addiction or BED had higher BMI levels than those without food addiction or BED. This finding may imply that food

addiction or BED, via unknown mechanisms, do not affect body weight in patients with heroin use disorder.

Impulsivity has been proposed as one of the links between eating disorders and substance use disorders [42]. For example, Kane et al. [43] have shown that women with comorbid bulimia and alcohol use disorders scored higher than bulimic women on Eysenck's Impulsiveness Scale. Furthermore, a study of university students has found that dispositional impulsivity (based on UPPS-P Impulsive Behavior Scale) was strongly associated with food addiction symptoms [44]. Contrary to previous studies, we found that heroin-dependent men, as well as controls with food addiction and those without food addiction reported comparable impulsivity on the BIS-11. Thus, we suggest that impulsivity is not a mediator of the relationship between food addiction and substance use disorders among men, regardless of substance use involvement. However, non-substance using participants (but not patients with heroin use disorder) with BED scored higher on the BIS-11 compared with those without BED. This finding may indicate that impulsivity may serve as a risk factor for the onset

**Table 4** Demographic and clinical features for 100 heroin-dependent patients with and without current binge eating disorder

Characteristics	Patients with BED ( <i>n</i> = 21)	Patients without BED ( <i>n</i> = 79)	<i>z</i> -score or $\chi^2$ value	<i>p</i> value
Age(years)*	25 (5)	25 (3.5)	−0.344	0.731
BMI (kg/m <sup>2</sup> )*	22.7 (2.4)	21.3 (3.4)	−1.862	0.063
Average daily heroin dose (g/day)*	4 (5.5)	3 (3)	−0.992	0.321
The age of heroin debut (years)*	18 (4)	18 (6)	−0.520	0.603
BIS-11*	65 (18.5)	66 (18)	−0.384	0.404
EAT*	13 (9.5)	13 (12)	−0.572	0.567
Characteristics of substance use*	0.4 (1)	0.5 (1.2)	−1.035	0.301
Dependency diagnosis*	11 (2.3)	11 (3)	−0.545	0.586
Effects of substance use on the user*	16.1 (3.5)	17 (3)	−0.662	0.508
Craving*	4 (5.5)	5 (4)	−0.557	0.578
Motivation to quit using substances*	6 (1)	6 (0)	−0.530	0.321
BMI categories**				
Underweight (<18.5 kg/m <sup>2</sup> )	0	2 (2.5%)	0.797	0.850
Normal weight (18.5–25 kg/m <sup>2</sup> )	19 (90.5%)	68 (86.1%)		
Overweight (25–30 kg/m <sup>2</sup> )	1 (4.8%)	6 (7.6%)		
Obese (>30 kg/m <sup>2</sup> )	1 (4.8%)	3 (3.8%)		
Self-mutilation**			1.717	0.190
Yes	7 (33.3%)	39 (49.4%)		
No	14 (66.7%)	40 (50.6%)		
Suicide attempt history**			0.669	0.413
Yes	6 (28.6%)	16 (20.3%)		
No	15 (71.4%)	63 (79.7%)		
Criminal record**			0.047	0.828
Yes	13 (61.9%)	46 (58.2%)		
No	8 (38.1%)	33 (41.8%)		
Route of heroin administration**			0.033	0.855
Smoked/chased	15 (81.5%)	58 (73.4%)		
Injected	6 (18.5%)	21 (26.6%)		

BED Binge eating disorder; BIS-11 Barratt Impulsivity Scale-version 11; BMI Body mass index; EAT Eating Attitudes Test

\*Median (IQR), Mann–Whitney *U* test; \*\* *n* (%),  $\chi^2$  test

**Table 5** Univariate analyses comparing selected characteristics of food addiction in control participants

Characteristics	Control participants with food addiction ( <i>n</i> = 12)	Control participants without food addiction ( <i>n</i> = 88)	<i>z</i> -score	<i>p</i> value
Age (years)*	25 (10.3)	23 (4)	−0.772	0.440
BMI (kg/m <sup>2</sup> )*	24.8 (3.4)	22.1 (3.2)	−2.604	0.009
BIS-11*	62 (11.8)	57 (11)	−1.370	0.171
EAT*	16.5 (9.5)	10 (5.8)	−3.569	<0.001

BIS-11 Barratt Impulsivity Scale-version 11; BMI Body mass index; EAT Eating Attitudes Test

\*Median (IQR), Mann–Whitney *U* test

**Table 6** Univariate analyses comparing selected characteristics of binge eating disorder in control participants

Characteristics	Control participants with BED ( <i>n</i> = 8)	Control participants without BED ( <i>n</i> = 92)	<i>z</i> -score	<i>p</i> value
Age (years)*	23.5 (9)	24 (4.8)	−0.128	0.898
BMI (kg/m <sup>2</sup> )*	24.9 (3.9)	22.1 (3.3)	−2.992	0.003
BIS-11*	67 (13.5)	57 (11)	−2.798	0.005
EAT*	17.5 (15.3)	10 (7)	−2.172	0.030

BED Binge eating disorder; BIS-11 Barratt Impulsivity Scale-version 11; BMI Body mass index; EAT Eating Attitudes Test

\*Median (IQR), Mann–Whitney *U* test

of BED in individuals without substance use disorders. Nevertheless, a high level of impulsivity is not an indicator for the development of BED in men with substance use disorders.

Craving is a core feature of addictive disorders, leading to the continuation of addictive behaviors and the occurrence of relapse in remitted patients [45]. It has been included as a substance use disorder criterion in the DSM-5 [33]. We found that patients with concurrent food addiction had higher craving scores compared to those without food addiction. However, a diagnosis of current BED was not associated with increased craving scores. According to these findings, food addiction, compared to BED, appears to be more appropriate for consideration within the addictive framework.

### Strengths and limitations

A major strength of this study is that it describes one of the largest cohorts of men with heroin use disorder to be assessed for co-occurring eating disorders, food addiction, and their correlates. Direct comparison with a normal control group is another strength. Furthermore, the prevalence of BED in our control group was 8%, which was similar to that found in a study (6.8%) that included individuals who were randomly selected from a community sample of 411 men [40]. This may indicate that our control group is fairly representative of the general population. However, these findings should be considered in view of several limitations. We examined the rates of eating disorders and food addiction in those patients with versus without substance use disorders among male inpatients admitted to a detoxification and therapy unit. Thus, our results might not be generalizable to other men with substance use disorder, including those who are not in treatment. Interviewers were not blind to participants. The frequency of eating disorders and food addiction found in our study groups might therefore be falsely elevated due to Berkson's bias [46] or to interviewer bias. The limited number of patients that met DSM-5 criteria for BED and YFAS criteria for food addiction renders our findings susceptible of statistical errors. Because of the cross-sectional design, we cannot establish inferences about causal relations between variables. These limitations help highlight the importance of future studies with longitudinal design and dimensional instruments that are able to clarify phenotypical associations involving substance use disorders, food addiction and BED.

### Conclusions

To our knowledge, this is the first study assessing food addiction and DSM-5-defined eating disorders in patients with substance use disorder. We found that BED and food

addiction were thrice as common in men with heroin use disorder as in men without substance use disorders. Among patients with heroin use disorder, co-occurrence of food addiction (but not BED) was associated with craving and a history of suicide attempts. This research enhances our knowledge about the association of BED, food addiction, and substance use in men. Future research is needed however to address the aforementioned limitations, replicate the current findings, and further elucidate the relationship between BED, food addiction, and substance use disorders in men. None of the patients meeting DSM-5 criteria for BED were previously diagnosed with BED, revealing unrecognized and unmet needs. Screening for BED and food addiction in patients with substance use disorder is warranted, as interventions such as dialectical behavior therapy may improve treatment outcome in individuals with concurrent disordered eating behaviors and substance use disorders [47].

### Compliance with ethical standards

**Conflict of interest** Authors Fatih Canan, Servet Karaca, Suna Sogucak, Omer Gecici, and Murat Kuloğlu declare that they have no conflict of interest with respect to the content of this manuscript.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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