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Is Food Addiction a Predictor of Treatment Outcome among Patients with Eating Disorder?

ABSTRACT

Objectives: The study aimed to examine whether food addiction (FA) was associated with greater severity in both binge eating disorders (BED) and bulimia nervosa (BN) and, therefore, to determine if FA was predictive of treatment outcome.

Method: 71 adult patients with BN and BED (42 and 29 respectively) participated in the study. Food addiction was assessed by means of the Yale Food Addiction Scale.

Results: The results confirmed a high prevalence of FA in patients with binge disorders (around 87%) and also its association with a greater severity of the disorder (i.e. related to an increased eating psychopathology and greater frequency of binge eating episodes). Although FA did not appear as a predictor of treatment outcome in general terms, when the diagnostic subtypes were considered separately, FA was associated with poor prognosis in the BED group. In this vein, FA appeared as a mediator in the relationship between ED-severity and treatment outcome.

Conclusions: Our findings suggest that FA may act as an indicator of ED severity and it would be a predictor of treatment outcome in BED, but not in BN.

KEYWORDS: eating disorders, food addiction, bulimia nervosa, binge eating disorder, treatment outcome

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Introduction

Food addiction (FA) is a controversial construct that has not been recognized as a diagnostic entity so far. However, FA is receiving an increased interest and a growing body of research in the last years (Fernández-Aranda, 2018). The concept of FA posits that individuals experience addictive-like symptoms related to the consumption of high-calorie/palatable foods (Davis, 2016; Meule, von Rezori & Blechert, 2014; Bonder et al., 2018) (such as preoccupation with obtaining a desired food, excessive consumption of unhealthy foods despite adverse health consequences, craving, impaired control, tolerance, withdrawal, and distress/dysfunction) (Fletcher & Kenny, 2018; Gordon, Ariel-Donges, Bauman, & Merlo, 2018), and with biological-hormonal maintaining factors (Novelle and Diéguez, 2018; Peters et al., 2018). It has been related to other addictive disorders due to the parallels in the neurochemistry (Tomasi et al., 2015; Gearhardt 2016; Jimenez-Murcia et al., 2017), specifically in terms of participation of the dopaminergic reward system and the activation of positive reinforcement mechanisms (Carter & Davis, 2010; Volkow, Wang, Fowler, Tomasi, & Baler, 2012; Racine et al., 2019). This evidence suggests that FA could be evaluated by considering the behavioral and symptomatology patterns observed in other addictions, as captured in the Yale Food Addiction Scale (YFAS) (Gearhardt, Corbin, & Brownell, 2009). Nevertheless, the debate about food addiction vs. eating addiction vs. non-addiction remains open (Meule, 2019). While some researchers have postulated for an integration of FA into substance use disorders (Gordon, Ariel-Donges, Bauman, & Merlo, 2018) others argue that it would be within behavioral addictions (Albayrak, Wölfle, & Hebebrand, 2012). On the other hand, other studies even doubt about the existence of underlying addictive processes and postulate the loss of control overeating as a core symptom of the ED (Fletcher & Kenny, 2018).

Despite FA has not yet been formally recognized by the Diagnostic and Statistical Manual for Mental Disorders (DSM-5; APA, 2013), it has emerged as a clinical entity recognized within the spectrum of obesity and abnormal eating behavior (Wiss and

Brewerton, 2017). Recent studies have showed a high prevalence of FA among patients with obesity and/or with an eating disorder (ED), especially among those with binge eating symptomatology (Granero et al., 2014; Granero et al., 2018; Wiss and Brewerton, 2017). Thus, studies on ED have found a high prevalence of FA in patients with bulimia nervosa (BN) (Meule et al. 2014 & Vries 2016; Granero et al., 2018) and binge eating disorder (BED) (Gearhardt, Boswell, & White, 2014 Smith and Robbins 2013, Penzenstadler et al. 2018), reaching rates ranging from 70-90% (Granero et al., 2014). In addition, FA has also been associated with higher eating-related severity and psychopathology (Granero et al., 2014; Imperatori et al., 2014), especially with greater levels of weight/shape overvaluation and body dissatisfaction, an increased frequency of binge eating episodes (Burrows, Hides, Brown, Dayas, & Kay-Lambkin, 2017; Burrows, Kay-Lambkin, Pursey, Skinner, & Dayas, 2018), as well as with more dysfunctional personality traits (Woltz et al., 2016) and emotional regulation deficits (Carlson et al, 2018).

The literature analyzing FA and response to treatment is very scarce and results are not yet conclusive. The few studies assessing the relationship between FA and treatment outcome in ED have focused on brief-interventions for patients with BN (Hilker et al, 2016) or on a food-specific inhibition training for patients with BED (Giel et al, 2017). In this vein, Hilker et al. (2016) found that severity of FA was a short-term predictor of abstinence from bingeing/purging episodes after a brief psychoeducational therapy among patients with BN (Hilker et al., 2016). However, other study applying food-specific inhibition training in patients with BED found that this intervention improved the inhibitory control towards high-caloric food stimuli but it was not able to produce changes in food craving or food addiction in these patients (Giel et al, 2017). Additionally, the findings regarding FA and weight loss interventions in patients with obesity are still controversial. While some authors found that FA may act as a predictor of less weight loss after a low calorie dietetic intervention (Guerrero Pérez et al., 2018), others have shown that the presence of FA before surgery was not associated with pre-surgical BMI neither postoperative weight loss (Ivezaj, Wiedemann, & Grilo, 2017).

Furthermore, some studies have revealed that the weight loss induced by a low calorie diet (Guzzardi et al, 2018) or by bariatric surgery (Pepino, Stein, Eagon and Klein, 2014; Sevinçer, Konuk, Bozkurt and Coşkun, 2016; Murray et al, 2019) induced remission of FA symptoms and improved several dietary behaviors associated with FA.

Thus, based on the available evidence abovementioned, we hypothesized that FA may act as an indirect measure of ED psychopathology and, therefore, it may be associated with poorer treatment outcome in patients with binge disorder, namely BN or BED. Therefore, and taking into account all the aforementioned gaps in the literature, the specific aims of the study were: 1) to analyze whether the presence of FA is associated with greater ED psychopathology in the different binge diagnoses (BN and BED); and 2) to analyze whether the presence of FA is associated with poor treatment outcome in patients with binge disorder, namely BN and BED, after an outpatient cognitive-behavioral therapy (CBT) intervention.

Methods

Participants and procedure

Sample comprised of 71 adult patients diagnosed with binge disorders (42 BN and 29 BED), who were consecutive referrals to the Eating Disorders Unit at Bellvitge University Hospital in Barcelona. ED diagnoses were made by means of a face-to-face semi-structured clinical interview (Fernández-Aranda and Turón, 1998), that has been updated based on the validated SCID-5 interview (First et al, 2015), and conducted by experienced clinical psychologists and psychiatrists. The inclusion criteria for the sample were as follows: a) 18 years and older; b) diagnosed with BN or BED according to DSM-5 criteria; (DSM-5; APA, 2013), and c) have completed a structured outpatient CBT group. Patients who dropped out the treatment were excluded from the present study (no statistical differences were found in the comparison between patients who completed and dropped out the CBT intervention, nor for the presence of a FA positive screening score [$p=.100$], nor for the FA severity level [$p=.443$], nor for the ED severity level [$p=.519$], nor for the age of onset of the ED [$p=.279$], nor for the duration of the disorder [$p=.235$], and neither for the disorder subtype [$p=.766$]).

The present study was approved by the Ethics Committee of our institution (the Ethics Committee of Clinical Research of the Bellvitge University Hospital), and all research was conducted in accordance with the latest version of the Helsinki Declaration. Signed informed consent was provided by all participants.

Assessment

Information about current ED symptoms, antecedents and other psychopathological data of interest, as well as other relevant sociodemographic and clinical variables were obtained by a face-to-face, standardized, structured interview. Additionally, the following commonly applied questionnaires in the field of EDs were employed:

- *Eating Disorders Inventory-2 (EDI-2)* (Garner, 1991). The Spanish validation of this questionnaire has been used (Garner, 1998) to assess psychological and behavioral characteristics of the ED. The internal consistency (coefficient alpha) for the current sample was excellent ($\alpha = .94$).

- *Yale food addiction Scale (YFAS)* (Gearhardt et al., 2009) (Spanish validation (Granero et al, 2014)). This is a 25-item self-report instrument that was designed to assess food addiction according to the seven symptoms of substance dependence listed in the DSM-IV-TR. When at least three criteria and significant clinical impairment are reported, a diagnosis of FA is given. Moreover, a symptom count, indicating FA severity, can be measured to provide a score between 1 and 7. The internal consistency of our sample was good ($\alpha = .84$).

Treatment

Treatment for BN and BED consisted of 16 weekly outpatient group therapy conducted by experienced psychologist. Patients with BN and BED were placed in separated therapy groups, but both treatment groups were based on the same CBT program. The treatment protocol was manualized and published in Spanish (Fernandez-Aranda and Turon, 1998). Its effectiveness has been described previously (Agüera et al., 2013).

Patients were re-assessed at discharge and categorized into the following three categories: full remission, partial remission, and non-remission. These categories were based on the consensus judgment of the senior clinical staff who considered all aspects of the patient's treatment outcome, such as frequency of binge episodes and compensatory behaviors (such as self-induced vomiting or laxative and diuretics misuse), and improvement in ED cognitions. To assess clinical significance of response to treatment, the therapists had access to objective primary measures, such as the number of bingeing/purging episodes per week, based on entries from a food diary. According to DSM-5 criteria (APA, 2013), the working definition of *full remission* was a total absence of symptoms meeting diagnostic criteria for at least 4 consecutive

weeks, *partial remission* was defined as substantial symptomatic improvement but with residual symptoms, and the patients who presented poor outcomes were defined as *non-remission*. These categories were previously used to assess treatment outcome in threshold ED in other published studies (Agüera et al. 2015; Agüera et al, 2017; Custal et al., 2014; Sauchelli et al., 2016; Steward et al., 2016).

Statistical analysis

Statistical analysis was carried out with Stata16 for windows. Partial correlations adjusted by sex and age estimated the association between the FA severity level with the other eating clinical variables (EDI-2 scores, BMI and frequency of binge eating episodes). In this analysis, and due the strong association between statistical significance for the R-coefficients and sample size (low-poor coefficients tend to achieve statistical significance estimated into large samples, while high coefficients tend to non-statistical significant into samples with a few number of participants), effect size was considered low-poor for $|R|>0.10$, moderate-medium for $|R|>0.24$ and large-high for $|R|>0.37$ (these thresholds corresponds to Cohen's-d of 0.20, 0.50 and 0.80, respectively (Rosnow and Rosenthal, 1996).

Logistic regression assessed the contribution of the participant's age, the diagnostic subtype (BED vs BN), the ED severity (EDI-2 total score) and the presence of FA (present vs absent) on the likelihood of a CBT poor treatment outcome (defined as non-remission). Fitting of the model was valued with the Hosmer-Lemeshow test (goodness-of-fit was considered for $p>.05$), global predictive capacity was measured with the Nagelkerke's pseudo- R^2 coefficient, and global discriminative ability with the area under the ROC curve (AUC) (effect size for $AUC<.65$ was interpreted as low-poor, for $.65<AUC<.70$ moderate-medium, and for $AUC>.70$ large-high; Steyerberg et al., 2001).

Path analysis procedures modeled as a case of structural equation modeling (SEM) estimated the underlying mechanism (including mediational links, direct and indirect effects) between the participants' age, the diagnostic subtype, the FA severity and the

ED severity on the likelihood of the CBT treatment outcome. In this work the maximum-likelihood estimation method of parameter estimation was defined and fitting was tested through standard statistical measures: the chi-square test (χ^2), the root mean square error of approximation (RMSEA), Bentler's Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the standardized root mean square residual (SRMR). Adequate goodness-of-fit was considered for (Barret, 2007): $p > .05$ in the (χ^2), $RMSEA < .08$, $TLI > .90$, $CFI > .90$ and $SRMR < .10$. The global predictive capacity of the model was measured by the coefficient of determination (CD). The model was obtained for the women subsample ($n=61$) since the low frequency of men in the sample did not allow fitting.

Results

Characteristics of the sample

Most of the participants were women ($n=62$, 87.3%), and single ($n=41$, 57.5%). Participants in the BN group were younger (mean=30.6 years-old, $SD=10.0$) compared to participants with BED (mean=39.3 years-old, $SD=9.9$) ($p=.001$), and the onset of the ED was also at an early age in the BN group [mean=19.1 years-old ($SD=6.6$) versus mean=25.2 years-old ($SD=11.3$), $p=.006$]. No differences between the groups emerged for the duration of the disorder [mean=11.3 years ($SD=10.7$) versus mean=15.3 years ($SD=9.8$), $p=.111$]. Table S1 (supplementary) includes the description for all the measures of the study and the comparison between the ED subtypes (BN vs. BED).

Comparison of the FA measures between sexes

All men in the study met clinical criteria, according to YFAS, for a positive screening score in the FA measure, and $n=54$ (87.1%) women also reported positive screening. However, the comparison of the difference was statistically non-significant ($p=.128$, but this result must be interpreted with caution due the small sample size) but effect size was into the moderate-medium range ($|d|=0.54$). Furthermore, the number of total DSM

criteria for FA was higher for women (mean=5.7, SD=1.3) compared to men (mean=5.1, SD=1.2) [(although the mean difference was statistically non-significant ($p=.182$), the effect size was into the moderate-medium range ($|d|=0.51$)].

Association of the FA severity with eating disordered measures

Table S2 (supplementary) includes the association between FA severity (number of FA criteria) and the EDI-2 scales (bulimia and impulse regulation scales, and the total score), BMI, and frequency of binge eating episodes (partial correlations adjusted by sex and age). When considering the total sample, a positive correlation between the FA and the number of weekly binge eating episodes and the ED psychopathology (measured by EDI-2) was found. In the BN group, FA level positively correlated with ED psychopathology (specifically with EDI-2 bulimia and total scores), BMI, and weekly frequency of binge eating episodes. For patients with BED, FA severity also positively correlated with the ED psychopathology and with the weekly frequency of binge eating episodes.

Baseline FA and Therapy Outcome among the ED subtypes

In Table 1 is displayed the percentage of patients with or without FA at baseline according to each therapy outcome category (full remission, partial remission and non-remission) among the ED subtypes (Figure 1 includes the bar-chart with the linear showing linear/quadratic trends). Whereas no differences between the groups were obtained in the resulting therapy outcome categories when considering the total sample and the BN subsample, there were significant differences obtained in the BED group. Namely, the participants with BED with baseline positive FA presented poorer treatment outcome than those with baseline negative FA (80.8% vs. 100% full remission, respectively).

--- Insert Table 1 and Figure 1 ---

Predictive model of the therapy outcome

Table 2 contains the final logistic regression, when considered the whole sample (BN and BED), for the criterion therapy outcome “non-remission”, considering as predictors the participants’ age, diagnostic type, ED psychopathology (measured by means of EDI-2 total score) and presence of FA (positive vs negative screening score). No significant interaction was found between the FA and the age ($p=0.347$), suggesting that the effect of the FA on the therapy outcome was equal independent of the participants’ age. The results of the model including the interaction parameter show that the risk of a poor therapy outcome is increased for older patients and those with a higher ED psychopathology at baseline. No predictive capacity on the therapy result was obtained for the diagnostic subtype and the FA. The model achieved good fitting (Hosmer-Lemeshow: $p=.715$), large-high predictive capacity ($R^2=.225$) and large-high discriminative ability ($AUC=0.833$).

--- Insert Table 2 ---

Pathways analysis (SEM)

Figure 2 contains the path-diagram with the standardized coefficients obtained in the SEM (complete results are in Table S3, supplementary). The model only retained the significant coefficients, and adequate goodness-of-fit was obtained: $\chi^2=1.27$ ($p=.259$), $RMSEA=0.067$, $CFI=0.993$, $TLI=0.935$ and $SRMR=0.031$. The results of the model showed that BED diagnosis and lower ED severity achieved direct effect on the CBT outcome, increasing the likelihood of full remission. Two mediational links also emerged: a) older age was related to both lower ED severity levels and presence of BED diagnosis, which increased the risk of good outcome; and b) lower FA severity were related to lower levels in the ED severity, which increased the odds of full remission. The global predictive capacity of the SEM was $CD=0.366$.

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Discussion

Although the interest in studying the association between FA and ED has increased drastically in the last few years, most of the published studies have used cross-sectional designs (Fernandez-Aranda et al., 2018). One of the few studies analyzing FA as a possible predictor of treatment outcome in patients with bulimic symptoms was carried out after a brief psychoeducational intervention (Hilker et al, 2016), and only the short-term effect was assessed. Hence, to our knowledge, this is the first study that attempted to address whether the presence of FA is associated with greater ED psychopathology and treatment outcome after a completed CBT outpatient program.

Firstly, as expected, this study confirmed previous findings on the high prevalence of FA in patients with BN (Meule et al. 2014 & Vries 2016) and BED (Gearhardt, Boswell, & White, 2014 Smith and Robbins 2013, Penzenstadler et al. 2018). Similar to previous studies (Granero et al., 2014), we found that about 87% of female patients with bulimic symptoms scored positive in the YFAS scale (Granero et al., 2014; Wiss and Brewerton, 2017). Males with ED even had higher rates of FA than their female counterparts. These results are in disagreement with another study that indicated a higher prevalence of FA in women than in men (Hauck et al, 2017). This inconsistency might be explained by the fact that our study assessed patients with ED, while the study of Hauck et al (2017) analyzed FA in the general population. Therefore, our findings may be slightly inflated because of increased severity of eating-related symptoms in males with EDs. However, these results should be interpreted with caution due the small sample size of the males with ED's.

Secondly, the main finding of our study confirms the association between FA and the ED psychopathology. Patients with FA, both BN and BED, scored higher in the EDI-2 questionnaire and presented more weekly frequency of binge-eating behaviors. These results are in line with previous literature that reported a direct association between FA, bingeing ED-subtype, and with greater eating and psychopathological severity (Granero et al., 2014). Some authors have even suggested that FA may be solely a marker of

severity especially associated with factors such as more frequent binge eating episodes (Imperatori et al., 2014; Burrows, Hides, Brown, Dayas, & Kay-Lambkin, 2017; Burrows, Kay-Lambkin, Pursey, Skinner, & Dayas, 2018), and that FA does not independently measure addictive mechanisms (Hilker et al, 2016; Granero et al., 2014; Ivezaj, Wiedemann, Lydecker, & Grilo, 2018). In addition, our results were not able to find significant differences between the presence of FA and BMI in ED, solely in those with BN. Hence, as suggested in previous studies (Villarejo et al., 2014), BMI may be a consequence of disinhibited eating behavior rather than a factor related to FA itself. In ED patients, FA may not predict disordered eating behavior indiscriminately but it might be specifically linked to disinhibited eating (Burgess, Turan, Lokken, Morse, & Boggiano, 2014).

Thirdly, and partially supporting our hypothesis, our findings showed a direct association between the presence of FA and a poor clinical outcome in BED, but not in BN or in the sample of ED as a whole. We found that the presence of FA in the subsample of patients with BED was associated with a lower likelihood of achieving full remission. Overall, patients with BED tend to show a better prognosis than patients with BN (Aguera et al., 2013; Linardon et al., 2019). However, this finding suggests that the presence of FA in patients with BED might be acting as a maintenance factor for binge eating episodes, possibly due to its effect on the impaired reward system characteristic of addictive processes. The extent to which patients with BED can benefit from approaches and interventions based on an addictive model should be elucidated in further studies.

In terms of clinical predictors, our results showed an association between ED psychopathology and CBT-outcome: the higher the ED psychopathology, the lower the probability of ED symptomatological remission. These results are in accordance with previous literature (Wagner et al., 2015; Lammers, Vroling, Ouwens, Engels, & van Strien, 2015; Vroling, Wiersma, Lammers and Noorthoorn, 2016; Dakanalis, Colmegna, Riva, & Clerici, 2017) reporting that ED psychopathology, such as binge

eating episodes and shape/weight concerns, are significant predictors of dropout, as well as high levels of body dissatisfaction are associated with poor outcomes. In addition, our results also showed that age played an important role in the prognosis of these disorders. In line with previous studies, our results evidenced that younger patients presented with higher ED psychopathology (Agüera et al., 2017). Contrastingly, our findings indicated an association between older age and higher YFAS scores. These results are not in line with a previous research reporting that the younger population exhibited a higher prevalence of FA (Hauck, Weiß, Schulte, Meule, & Ellrott, 2017). However, these discrepancies may be due to the fact that the study of Hauck et al (2017) analyzed people in the general population, while we assessed patients with binge disorders. Therefore, in our sample, older patients with binge disorders may be those with a longer duration of the disorder and increased FA symptomology (Hauck, Weiß, Schulte, Meule, & Ellrott, 2017).

Finally, one of the most striking findings of our study was that FA *per se* was not directly associated with the response to treatment. These findings are not in accordance with a prior study reporting that FA severity is a short-term predictor of abstinence from bingeing/purging episodes in patients with BN after a brief group treatment (Hilker et al, 2016). However, although we were not able to find a direct effect of FA on the treatment outcome, FA seems to act as a mediator in the relationship between ED psychopathology (measured by the total EDI-2 score) and treatment outcome. In this sense, FA may act as a marker of the severity of the ED and, therefore, is the severity of the disorder (increased and impaired by the FA), rather than the presence of FA for itself, which acts as a predictor of non-remission.

Limitations and strengths

Some limitations must be taken into account when interpreting the results of this study. First, we used the first version of Yale Food Addiction Scale (YFAS) (Gearhardt, Corbin, & Brownell, 2009) that was developed to operationalize indicators of addictive-like eating, originally based on the Diagnostic and Statistical Manual of Mental

Disorders 4th edition Text Revision (DSM-IV-TR) criteria for substance-use disorders. However, it would be useful to replicate the results using the updated version of this scale (i.e. YFAS 2.0). The YFAS 2.0 was developed to reflect changes to diagnostic criteria in the DSM-5 (Gearhardt, Corbin, & Brownell, 2016). Second, the limited sample size and, especially the lack of males in the sample, does not allow us to generalize the results. Third, the present study did not use the same standardized questionnaires at the end of the treatment (as objective measures), which would have contributed to the reliability and objectivity of our longitudinal findings. Finally, we were not able to analyze the presence of FA before the disorder, so we cannot confirm that FA came prior to the ED and, therefore, acts as a risk factor for the severity of the ED or, on the contrary, a greater severity of the disease causes greater FA presence, as a marker of severity.

Notwithstanding these limitations, the current study also has several strengths that should be noted. As far as we know, this is the first study assessing whether FA may act as a possible predictor of treatment outcome in patients with BN and BED. Also, the findings derived from this study might improve our ability to better understand the influence of FA in the prognosis of these patients and thereby aid in tailoring the best treatment alternatives.

Clinical Implications

In the light of these findings, FA might be interpreted as a severity index of the ED indirectly associated with treatment outcome. Therefore, it would be necessary to determine which therapeutic tools might be effective for the treatment of FA, especially in patients with BED. In this sense, further studies are needed to assess the extent to which patients with BED can benefit from other approaches and interventions based on the addictive model to improve treatment outcomes (Meule, 2019). However, it is a controversial point because, despite the neurobiological and clinical similarities between FA and addictive disorders, the consumption of food (unlike alcohol,

substances or gambling) is necessary for life, making it impossible to design a treatment based on total abstinence.

Conclusions

In conclusion, our findings confirm the high presence of FA in a clinical sample of EDs, concretely in bingeing ED subtypes. Our results also indicate that high FA levels were associated with greater ED psychopathology in patients with BED and BN. The presence of FA was found as a predictor of treatment outcome just in the case of BED, but not in BN. Finally, the results suggest that FA may act as a marker of severity and, therefore, also as a mediator between ED severity and treatment outcome, especially for patients with BED.

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Table 1 Association between FA at baseline and treatment outcome among ED subtypes

Food addiction→	Total sample				BN				BED			
	No n=8	Yes n=63	p	d	No n=5	Yes n=37	p	d	No n=3	Yes n=26	p	d
Full remission	62.5%	57.1%	.882	0.11	40.0%	40.5%	.826	0.01	100%	80.8%	.444	0.69 [†]
Partial remiss.	25.0%	33.3%		0.18	40.0%	48.6%		0.17	0%	11.5%		0.51 [†]
Non-remission	12.5%	9.5%		0.10	20.0%	10.8%		0.26	0%	7.7%		0.41

Note. BN: bulimia nervosa; BED: binge eating disorder. |d|: Cohen's-*d* coefficient (absolute value).

*Bold: significant comparison (.05 level).

[†]Bold: effect size into the moderate-medium ($|d|>0.50$) to large-high range ($|d|>0.80$).

Table 2 Predictive capacity of FA level on the poor outcome (non remission): logistic regression (n=71)

	Coefficients					Fitting		
	B	SE	p	OR	95%CI(OR)	R ²	AUC	H-L
Age (years-old)	0.106	0.049	.013*	1.11	1.01 1.22	.225	.833	.715
Diagnosis (0=BN; 1=BED)	-1.651	1.007	.073	0.19	0.03 1.38			
ED severity (EDI2 total)	0.022	0.013	.045*	1.02	1.01 1.05			
FA (0=negative; 1=positive)	-2.070	1.465	.164	0.13	0.01 2.23			
Interaction FA-by-Age	Parameter excluded due the non-significant result: $p=.347$							

Note. BN: bulimia nervosa. BED: binge eating disorder. ED: eating disorder. FA: food addiction.

R²: Nagelkerke's pseudo R². AUC: area under ROC curve. H-L: Hosmer-Lemeshow test (*p-value*).

*Bold: significant parameter (.05 level).

Figure 1

Bar-chart for the percentage of participants in each therapy outcome condition (full remission, partial remission and non-remission) (n=71)

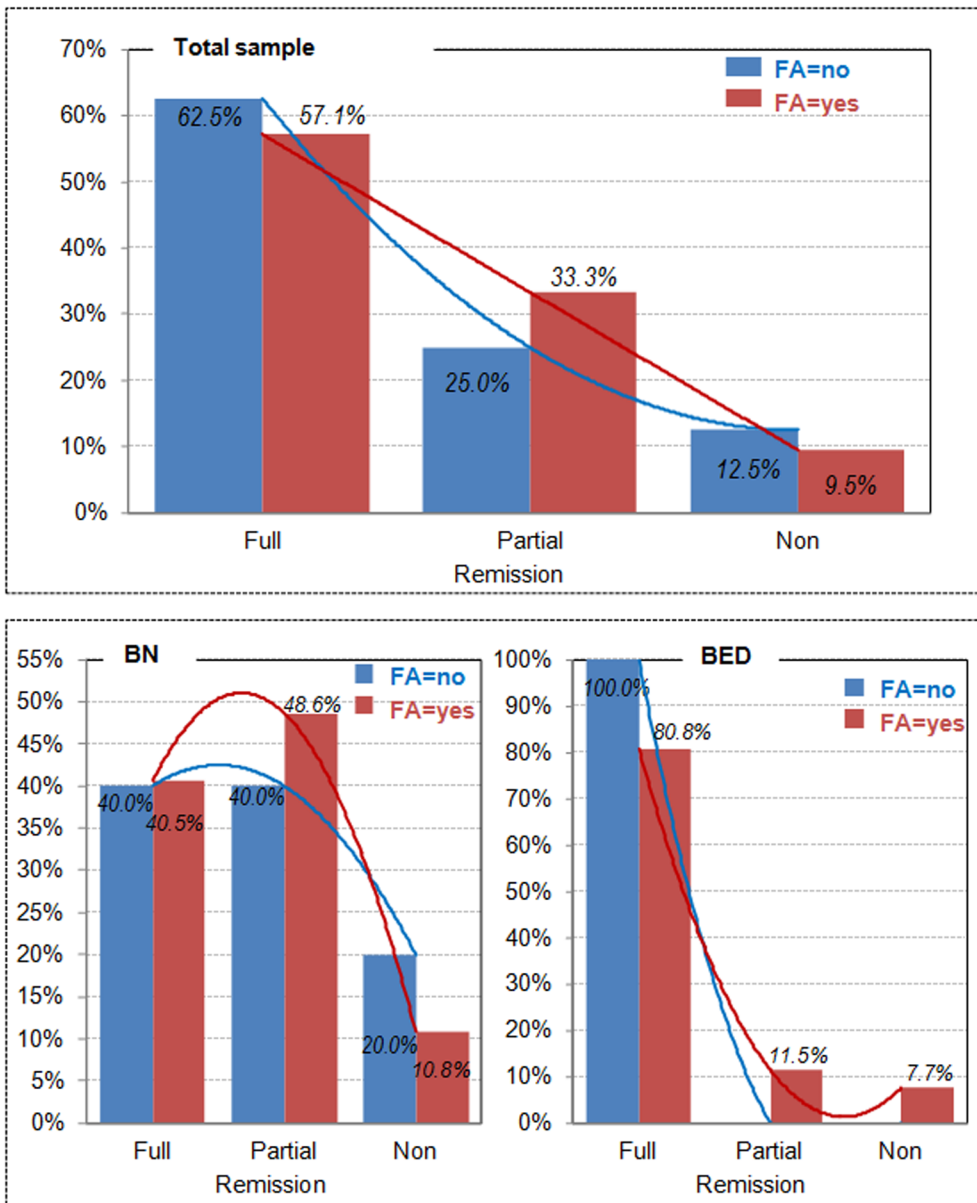
Note. FA: food addiction. BN: bulimia nervosa. BED: binge eating disorder.

Blue color line: linear/quadratic trend for the FA=no condition.

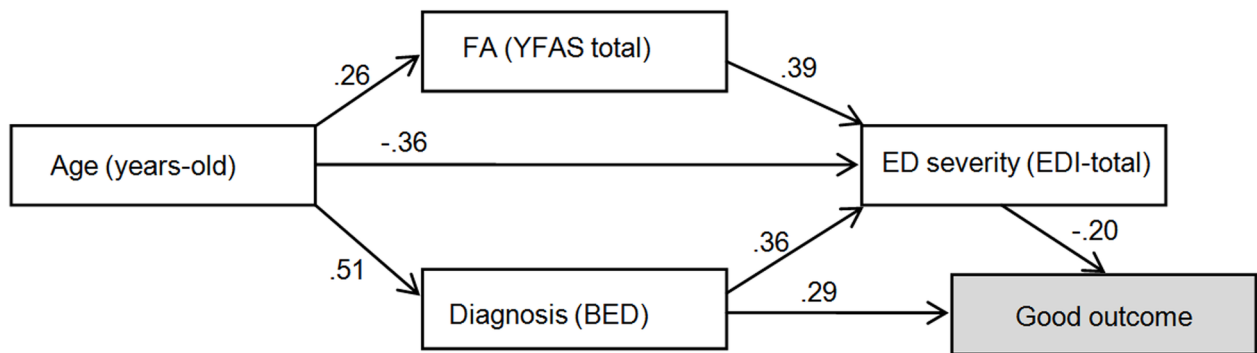
Red color line: linear/quadratic trend for FA=yes condition.

Figure 2

SEM: path-analysis obtained for the dependent variable “full-remission”.



ERV_2705_Figure 1.tif



ERV_2705_Figure 2.tif