

## Regular Article

# Lifetime substance abuse, family history of alcohol abuse/dependence and novelty seeking in eating disorders: Comparison study of eating disorder subgroups

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**Aim:** To assess lifetime substance abuse, family history of alcohol abuse/dependence, and novelty seeking in three different eating disorder groups (anorexia nervosa–restrictive; anorexia nervosa–binge eating/purging; anorexia nervosa to bulimia nervosa).

**Method:** A total sample of 371 eating disorder patients participated in the current study. Assessment measures included the prevalence of substance abuse and family history of alcohol abuse/dependence as well as the novelty-seeking subscale of the Temperament and Character Inventory–Revised.

**Results:** Significant differences across groups were detected for lifetime substance abuse, with anorexia nervosa–restrictive individuals exhibiting a significant lower prevalence than the anorexia nervosa to bulimia nervosa and anorexia nervosa–binge eating/

purging patients ( $P < 0.01$ ). For family history of alcohol abuse/dependence the same pattern was observed ( $P = 0.04$ ). Novelty seeking was associated with substance abuse ( $P = 0.002$ ), with the anorexia nervosa to bulimia nervosa group exhibiting significantly higher scores on the novelty-seeking scale than the other two groups ( $P < 0.001$ ). But family history of alcohol abuse/dependence was not related to novelty seeking ( $P = 0.092$ ).

**Conclusion:** Lifetime substance abuse appears to be more prevalent in anorexia nervosa patients with bulimic features. Higher novelty-seeking scores may be associated with diagnosis cross-over.

**Key words:** anorexia nervosa, bulimia nervosa, eating disorders, personality, substance abuse.

REVIEWS OF THE literature on co-occurring substance use in eating disorders (ED) indicate that individuals with bulimic features are generally more likely to abuse alcohol and other drugs than individuals suffering from the restricting subtype of anor-

exia nervosa (AN-R; Calero *et al.*, unpubl. data, 2008),<sup>1–4</sup> although this observation is not universal at intake diagnosis.<sup>5,6</sup>

As previous studies have suggested, this disparity across ED subtypes may reflect variations in patterns of familial liability to ED.<sup>7–9</sup> In relation to AN, increased occurrence of substance use disorders has been reported among relatives of non-substance-abusing underweight AN individuals with binge eating compared to AN-R, and to weight-recovered AN patients who subsequently cross over to bulimia nervosa (BN).<sup>10,11</sup>

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Previous studies have shown that, in particular, a predisposition to alcoholism seems to be genetically transmitted.<sup>12</sup> In addition, other studies have documented higher rates of comorbid and familial alcohol and substance use disorders in women with bulimia and their family members.<sup>13–15</sup>

A recent review on the sensitivity to reward and punishment in ED has advocated that specific personality traits such as impulsivity and sensation seeking may predispose a person both to ED and to substance abuse (O'Brien & Treasure, unpubl. data, 2008). In particular, that review showed that patients with bulimic symptoms had higher scores on sensation seeking, than individuals with AN-R and controls, and this has also been supported by recent studies.<sup>16</sup>

According to Cloninger *et al.*, temperament is largely heritable.<sup>17</sup> Research on the genetic background of Cloninger's temperament model has been most active in relation to novelty seeking.<sup>18</sup> It has been observed that maternal and paternal frequency of alcohol intake was associated with offspring temperament and character dimensions, particularly novelty seeking.<sup>19</sup>

In summary, evidence exists that even though substance abuse is infrequent in individuals with AN-R, in AN women with bulimic symptoms, the occurrence of substance abuse seems to be analogous to or surpass that in patients with BN. Variations in patterns of familial liability and in novelty seeking may account for these differences but have not previously been assessed in AN patients and individuals who subsequently cross over to BN.

Accordingly, we hypothesize that patients who exhibit bulimic symptoms when underweight will have greater prevalence of substance abuse than those who have purely restrictive symptomatology and those who cross over to BN after weight restoration. Furthermore, we hypothesize that these patients will also report a greater family history of alcohol dependence. Finally we assumed that higher novelty seeking would be associated with substance use and that family history of alcohol abuse/dependence would predict novelty seeking.

## METHODS

### Participants

A total sample of 371 female ED patients participated in the current study (AN-R,  $n = 130$ ; AN-binge eating/purging [AN-BP],  $n = 119$ ; and AN to BN

[AN-Cross],  $n = 122$ ). Participants were consecutive referrals for assessment and treatment at the Eating Disorder Unit at the Department of Psychiatry of the University Hospital of Bellvitge in Barcelona. All participants were diagnosed according to DSM-IV-TR criteria.<sup>20</sup> The mean age for the total sample was  $24.77 \pm 5.54$  years.

### Assessment

#### Evaluation of lifetime substance abuse and family history of alcohol abuse/dependence

The patients were assessed using a structured clinical face-to-face interview modeled after the Structured Clinical Interview for DSM-IV (SCID-I),<sup>21</sup> covering ED and lifetime presence of impulsive behaviors (namely alcohol and drug abuse, comorbid impulse control disorders and suicide attempts) and family antecedents of alcohol abuse/dependence.

#### Novelty-Seeking subscale of the Temperament and Character Inventory-Revised

The Novelty Seeking subscale of the Temperament and Character Inventory-Revised (TCI-R) is a reliable and valid four-item, 5-point Likert subscale that measures one of the four temperament domains of the TCI-R.<sup>22</sup> The performance on the Spanish version of the revised TCI-R produced an internal consistency (coefficient  $\alpha$ ) of 0.87.<sup>23</sup>

### Procedure

Experienced psychologists and psychiatrists completed the anamnesis during two structured face-to-face interviews before any psychological or pharmacological treatment was implemented. In addition to the clinical interview further demographic information was obtained through self-report questionnaires. All patients gave their informed consent to participate in the study and patient anonymity was preserved, the protocol of which was approved by the institutional Ethics Committee of University Hospital of Bellvitge.

### Statistical analysis

The statistical analysis was conducted using SPSS version 15.0 (SPSS, Chicago, IL, USA). All significance tests were two-tailed. One-way analysis of variance (ANOVA) and  $\chi^2$  tests were applied to compare

the continuous and discrete variables in the study groups. For the ANOVA analyses, Bonferroni post-hoc comparisons were conducted to assess which groups differed, and for the  $\chi^2$  test Holmes analysis was carried out to correct for multiple comparisons.

Logistic regression with the ENTER procedure was used to evaluate the extent to which novelty seeking (independent variable) could predict the presence or absence of lifetime substance abuse (dependent variable). The model was adjusted by ED diagnosis, age of onset, body mass index (BMI) and education, with the AN-R group entered as the reference group. The model's ability to discriminate between groups was assessed with the area under the receiver operating curve (AUC). The model's calibration was examined using the Hosmer and Lemeshow test. Finally, Nagelkerke  $R^2$  was used to estimate how much variance was accounted for in the model.

The associations among age of onset, maximum BMI, ED diagnosis, family history of alcohol abuse/dependence, education and total novelty seeking was

analyzed on linear regression. Total novelty seeking, a continuous variable, was used as the dependent variable, while the remaining variables were used as independent variables. No interaction terms were included because none of the multiplicative interactions was significant after Bonferroni adjustment.

## RESULTS

### Sociodemographic and clinical variables

Table 1 details the sociodemographic and clinical information of the three ED subgroups AN-R, AN-BP and AN-Cross. Groups did not differ on education, current age or number of previous treatments. Statistically significant differences across the groups emerged for marital and employment status, age of onset, duration of the disorder, current, minimum, and maximum BMI as well as weekly frequency of binge eating and vomiting episodes and laxative use.

**Table 1.** Subject details by eating disorder diagnostic subtype

		AN-R (n = 130)	AN-BP (n = 119)	AN-Cross (n = 122)	P	Eating disorder group differences
Sociodemographics						
Marital status (%)	Single	66.6	60.2	43	0.002	AN-Cross < AN-R = AN-BP
Education (%)	Primary	20.8	21.5	27.1	0.33	N.S
	Secondary	54.1	58.0	58.4		
	University	23.3	16.8	11.9		
Employment status (%)	Employed	31.1	30.5	47.4	0.02	AN-Cross > AN-R = AN-BP AN-BP > AN-Cross = AN-R AN-R > AN-Cross = AN-BP
	Unemployed	12.6	21.9	12.1		
	Student	34.5	25.7	27.6		
Age (years)	Mean $\pm$ SD	24.12 $\pm$ 6.19	24.85 $\pm$ 5.59	25.38 $\pm$ 5.36	0.22	N.S
Clinical features						
Age of onset (years)	Mean $\pm$ SD	19.97 $\pm$ 4.63	18.44 $\pm$ 4.42	17.48 $\pm$ 4.37	<0.001	AN-R > AN-BP = AN-Cross
Duration of disorder	Mean $\pm$ SD	3.99 $\pm$ 3.88	6.47 $\pm$ 4.94	8.16 $\pm$ 5.11	<0.001	AN-R < AN-BP < AN-Cross
No. previous treatments	Mean $\pm$ SD	0.96 $\pm$ 1.16	1.38 $\pm$ 1.51	1.07 $\pm$ 1.45	0.10	N.S
Current BMI	Mean $\pm$ SD	16.16 $\pm$ 1.88	16.55 $\pm$ 1.91	20.90 $\pm$ 2.47	<0.001	AN Cross > AN-R = AN-BP
Maximum BMI	Mean $\pm$ SD	21.67 $\pm$ 2.88	22.58 $\pm$ 3.14	24.13 $\pm$ 3.57	<0.001	AN Cross > AN-R = AN-BP
Minimum BMI	Mean $\pm$ SD	15.12 $\pm$ 1.64	15.33 $\pm$ 1.72	16.45 $\pm$ 1.46	<0.001	AN Cross > AN-R = AN-BP
Weekly no. binges	Mean $\pm$ SD	0	1.94 $\pm$ 4.08	8.41 $\pm$ 8.00	<0.001	AN-R < AN-BP < AN-Cross
Weekly no. vomits	Mean $\pm$ SD	0	5.13 $\pm$ 6.49	9.17 $\pm$ 9.56	<0.001	AN-R < AN-BP < AN-Cross
Weekly use of laxatives	Mean $\pm$ SD	0	7.37 $\pm$ 14.42	7.06 $\pm$ 29.13	0.01	AN-R < AN-BP = AN-Cross
Substance abuse (%)	Present	8.8	26.3	35.2	<0.001	AN-R < AN-BP = AN-Cross
Family alcohol abuse/dependence (%)	Present	19.4	29.9	34.7	0.04	AN-R < AN-BP = AN-Cross
TCI-R novelty seeking score	Mean $\pm$ SD	95.57 $\pm$ 15.13	99.35 $\pm$ 15.12	108.47 $\pm$ 15.40	<0.001	AN-Cross > AN-BP = AN-R

AN-BP, anorexia nervosa purging-bingeing subtype; AN-Cross, anorexia nervosa to bulimia nervosa; AN-R, anorexia nervosa restrictive subtype; BMI, body mass index; TCI-R, Temperament and Character Inventory–Revised.

### Prevalence of lifetime substance abuse and family history of alcohol dependence by ED subtype

Results presented in Table 1 also indicate that groups differed in the observed frequency of lifetime substance abuse, with the AN-R individuals exhibiting significantly less lifetime substance abuse ( $n = 9$ , 8.8%) compared with the AN-BP ( $n = 26$ , 26.3%) and AN-Cross patients ( $n = 43$ , 35.2%;  $P < 0.001$ ). For family history of alcohol abuse/dependence the same pattern of findings was observed (AN-R:  $n = 19$ , 19.4%; AN-BP:  $n = 29$ , 29.9%; AN-Cross:  $n = 42$ , 34.7%,  $P = 0.04$ ). Participants with AN-BP and AN-Cross were similar, and reported a significantly higher prevalence of family history of alcohol abuse/dependence than participants with AN-R. Significantly higher mean TCI-R novelty-seeking scores were obtained for the AN-Cross group than for the AN-R and AN-BP groups ( $P < 0.001$ ).

### Novelty seeking, lifetime substance abuse and family history of alcohol abuse/dependence

Logistic regression analysis indicated that novelty seeking was significantly associated with substance abuse in patients with bulimic features, namely AN-BP and AN-Cross, but not in AN-R individuals (odds ratio, 1.034; 95% confidence interval [CI]: 1.01–1.06,  $P = 0.002$ ). Moreover, the adjustment of the model was correct ( $P = 0.767$  on Hosmer and Lemeshow test). The total variance accounted for in the model was 16.6%. Furthermore, the model was able to discriminate among the groups because the AUC was 0.505. Finally we found that family history of alcohol dependence was not significantly associated with novelty-seeking scores in the patient ( $\beta = 3.6$ , 95%CI:  $-0.59$ – $7.78$ ;  $P = 0.09$ ). The total variance accounted for in the model was only 3.4%.

## DISCUSSION

Our first hypothesis was only partially supported because we found that both the AN-Cross and the AN-BP group exhibited the highest prevalence for substance use and family history of alcohol dependence. But we were not able to show that the AN-BP group had higher values than the AN-Cross group. Furthermore our second hypotheses was also only to some extent confirmed. Novelty seeking was signifi-

cantly associated with substance use in individuals with bulimic features, but no differences were observed for AN-BP and AN-Cross groups. In contrast, the AN-Cross group had significantly higher scores on novelty seeking when compared to the AN-R and AN-BP groups. Finally, family history of alcohol abuse/dependence was not associated with the patients' novelty seeking scores.

The present finding that the AN-BP and AN-Cross patients had significantly higher prevalence of substance use than the AN-R patients confirms previous research in which those individuals with BN or with a history of bulimic symptoms in the course of AN reported higher prevalence of substance use disorders (Calero *et al.*, unpubl. data, 2008).<sup>1,11,24</sup> Given that substance abuse and dependence are correlated with worse outcomes from ED<sup>25</sup> and greater comorbidity<sup>11</sup> it is germane that we attempt to identify characteristics or personality features associated with alcohol and drug problems in this patient population.

In relation to family and genetic factors, our findings that family history of alcohol abuse/dependence was significantly lower in the AN-R than in the AN-BP and AN-Cross groups is also in line with earlier studies.<sup>7,8</sup>

The frequent association of substance use disorders and ED has led some authors to consider this comorbidity as part of an overall addictive dimension of personality.<sup>1,26,27</sup> In addition, impulsivity has been associated with both bulimic behaviors and substance use problems.<sup>28</sup>

Finally, the present results concerning the link between novelty seeking and substance use in the AN-BP and AN-Cross but not the AN-R group concurs with recent studies (O'Brien & Treasure, unpubl. data, 2008).<sup>4,29</sup> The elevated novelty seeking scores found in the present bulimic groups (AN-BP and AN-Cross) may be related to the emergence of binge eating at some point during the course of the eating disturbance.<sup>2,16,30</sup>

The use of behavioral models of binge eating and other feeding protocols is beginning to clarify the overlap between binge eating and substance use behaviors. Animal models have shown that neural signals relevant to binge eating are comparable with those involved in substance abuse.<sup>31</sup> For example, animal studies have shown increased self-administration of ethanol, alcohol and cocaine under conditions of food deprivation.<sup>32–34</sup>

In humans it is possible that individuals with higher baseline novelty seeking may also become

more vulnerable to substance abuse under conditions of food deprivation such as that seen in AN and BN, be it long-term starvation or the fluctuating availability associated with the binge/starve pattern of BN. Accordingly, there is evidence suggesting that food restriction induces changes in dopaminergic transmission, including hyperresponsiveness to novelty and environmental stimuli that signal opportunity for drive reduction.<sup>35</sup> Individual differences in the magnitude of this response have been found to correlate with rewarding effects of the drugs and the personality trait of novelty seeking.<sup>35</sup>

When we looked at novelty seeking scores and compared them among all three groups, we observed that AN-Cross had significantly higher scores than the two other groups: AN-R had the lowest whereas AN-BP had intermediate scores. Novelty seeking may be associated with substance abuse in those with bulimic features but may also be related to diagnostic instability. Other studies have pointed to personality traits as factors that might mediate ED diagnostic cross-over.<sup>36</sup>

Treatment approaches addressing both conditions may therefore eventually produce superior effectiveness than those that concentrate exclusively on the disorder for which the individual sought treatment. This is especially so if the factors that prompt both the ED and substance abuse behaviors are common (i.e. underlying novelty seeking) and if the behaviors are interrelated (e.g. food deprivation increasing the risk of substance use, and substance use disinhibiting binge eating).

The present results should be considered within the context of several limitations. First, the retrospective and self-report data collection procedures may limit the validity and the reliability of our findings. Second, the cross-sectional design does not allow us to determine causality of the variables assessed. Third, the risk of spurious results due to comorbidity of index patients with Axis I and Axis II diagnoses should be considered. Fourth, we were not able to assess family history of other substances than alcohol abuse/dependence. Finally, because in our study the novelty-seeking subscale of the TCI-R was measured after the diagnosis of the ED, the measurement in the AN groups was performed under food deprivation and hence it is difficult to discuss baseline novelty seeking in this study design. Balancing these shortcomings was the fact that we used a large sample size of ED patients and that the sample sizes of each of the subdiagnoses were equivalent.

Several unanswered questions remain for future study. Research in this area could improve by exploring longitudinal patterns of temporal association. Second, even though bingeing and purging behaviors in AN often take place concurrently, it has been proposed that purging rather than bingeing is most strongly associated with severity of psychopathology. Therefore future research should assess whether comorbid substance use differs among AN individuals with exclusively bingeing or purging symptom patterns.

In summary, the presence of a lifetime history of substance use may be particularly prevalent in patients with bulimic characteristics with high novelty seeking. ED and substance abuse may represent expressions of a fundamental predisposition to addictive behavior, possibly related to the genetically influenced trait of novelty seeking. Higher novelty seeking may be associated with diagnostic cross-over from AN to BN.

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