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Predictors of Food and Alcohol Disturbance onset or remission: A one-year longitudinal follow-up study

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Author contributions

All authors have approved the final manuscript.

L. Ritz: data analyses, writing, data interpretation; N. Mauny: study design, methodology, review and editing; P. Leconte and N. Margas: supervision, data interpretation, writing (review and editing).

Conflict of interest

The authors declare no conflict of interest.

Abstract

Objectives: This paper investigates the evolution of Food and Alcohol Disturbance (FAD) among college students in a one-year longitudinal follow-up study and identifies predictors associated with the onset or remission of FAD.

Method: A longitudinal online survey was conducted with 466 university students. The survey included an assessment of FAD using the CEBRACS, alcohol use and alcohol-related problems, risk of eating disorders and physical activity, administered twice, one year apart. We examined the evolution of frequency and engagement in FAD over one year. We also identified predictors associated with onset and remission of FAD and we determined whether these identified predictors evolve concomitantly with FAD behaviors.

Results: Over 1 year, the frequency of FAD did not change in university students. Nine percent were FAD-onset and 6% FAD-remission at the one-year mark. FAD-positive students at time 1 no longer engaged in FAD at time 2, especially for alcohol and dietary restraint motives. FAD-onset was predicted by dietary restraint, risk of eating disorders, and heavy alcohol use. FAD-remission was predicted by laxative use, dysfunctional exercise, and alcohol-related problems. Over 1 year, FAD-onset students showed a decrease in the frequency of dietary restraint, while FAD-remission students experienced a decrease in alcohol-related problems.

Discussion: FAD-onset among university students is surprisingly associated with decreased food deprivation and increased risk of alcohol-related problems. FAD-remission is associated with a decreased risk of alcohol-related problems, although the risk of eating disorders persists. These findings have important implications for the management of treatment and prevention strategies.

Keywords: food and alcohol disturbance, eating disorders, alcohol use disorder, drunkorexia, follow up, predictor, remission, onset

Public significance statement: Food and Alcohol Disturbance (FAD) remission in students is associated with a decreased risk of alcohol use disorder but a persistent risk of eating disorders. FAD-onset is associated with an increased risk of alcohol use disorder but a reduction in food deprivation. FAD behaviors are associated with more severe alcohol use and related problems and may lead to a chronic risk of eating disorders.

1. Introduction

Food and Alcohol Disturbance (FAD) refers to the engagement in compensatory behaviors (restricting eating and/or purging) before, during and/or after alcohol consumption, to offset calories consumed from alcohol and/or to increase alcohol intoxication (Choquette, Rancourt, et al., 2018).. FAD is associated with the amount of alcohol consumed (Gorrell et al., 2019; Rahal et al., 2012; Simons et al., 2021), alcohol-related consequences (Giles et al., 2009; Simons et al., 2021) and risk indices of developing alcohol-related problem (i.e., AUDIT score) (Choquette, Ordaz, et al., 2018; Horvath et al., 2020; Hunt & Forbush, 2016; Pinna et al., 2024). FAD behaviors are also associated with disordered eating (Pietrabissa et al., 2018; Pinna et al., 2024; Simons et al., 2021), fasting, purging, laxative use, excessive exercise and binge eating (Hunt & Forbush, 2016; Pompili & Laghi, 2018b). More precisely, deliberate caloric restriction prior to alcohol consumption, particularly in women, was associated with greater disordered eating and alcohol problems (Roosen & Mills, 2015). More specifically, women who reduced their food intake prior to drinking to avoid weight gain had higher levels of disordered eating, whereas women who reported reducing food intake to get drunk faster had higher levels of alcohol problems. Furthermore, weight control motivation is more strongly associated with FAD in women than men and more prevalent among heavier drinkers compared with lighter drinkers (Eisenberg & Fitz, 2014).

The Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale (CEBRACS) is the most commonly used measure of FAD in previous studies (Shepherd et al., 2021). Using the cut-off point of the CEBRACS total score, previous studies have shown a relatively high prevalence of FAD behaviors, affecting up to 55% of college students (Choquette, Ordaz, et al., 2018; Knight et al., 2017; Moeck & Thomas, 2021; Palermo et al., 2021; Peralta et al., 2019; Pietrabissa et al., 2018; Pinna et al., 2024). This finding points to the fact that FAD behaviors are not uncommon. The use of the CEBRACS cut-off score can identify individuals at risk of FAD, and the subscales can provide insight into whether this risk is due to alcohol-related problems or eating disorders. Our previous study conducted on university students (Ritz et al., 2023) revealed that the CEBRACS total score is strongly associated with several indices of alcohol use (e.g., age of onset of drinking, AUDIT score, number of standard drinks per week, and number of days of alcohol consumption) and of eating disorders (e.g., frequency of laxative/diuretic use, dietary restraint, exercising, SCOFF score, and eating disorder risk identification scale). More precisely, each of the CEBRACS subscales was specifically associated with either alcohol or eating disorder variables. The

alcohol subscale (“enhancement the effects of alcohol”) appeared strongly related to the AUDIT score, the number of drinks per week, the SCOFF and the frequency of dietary restraint. The “dietary restraint and exercise” subscale was strongly related to the SCOFF score and the frequency of dietary restraint and exercising. Finally, the “purging” subscale, linked to the frequency of laxative/diuretic use and the “vomiting and extreme fasting subscale”, was strongly associated with the SCOFF score and the frequency of dietary restraint.

Even if previous studies identified variables associated to FAD behaviors, their cross-sectional design inherently limits the ability to investigate the evolution of FAD behavior in time, to establish clear causal relationships between these variables and to understand the processes associated with the onset or remission of FAD. Yet, those questions are essential for both theoretical and clinical purposes. Hence, this study aimed 1) to assess the evolution of FAD among university students over a one-year period, including changes in its prevalence and frequency on their different motives; 2) to determine the effectiveness of correlates identified in the existing literature (alcohol and eating disorder variables) in predicting the onset or remission of FAD at the one-year follow-up assessment; and 3) to examine whether these variables which are identified as predictors of FAD evolution over a one-year period, evolve in parallel with FAD behaviors

2. Material and Methods

2.1. Participants

This longitudinal study is part of a larger research program that aims to examine substance consumption among young adults (ADUC; Alcohol and Drugs at University of Caen) and follows up on previous research that validated the French version of the CEBRACS (Ritz et al., 2023).

The present study was a follow-up investigation with two measurement points: Time 1 (October) and Time 2 (October; one year later). The participants were recruited from the University of Caen Normandy (France) by means of an online survey between 2021 and 2023. All participants in the study were native French speakers. They were invited to participate via their formal university email address and the University Information System Direction developed a secure system to guarantee complete anonymity for responders. Each participant was assigned a unique longitudinal code. The same online survey, using the Limesurvey® application and hosted by University of Caen Normandy server, was administered to students

each year. The final sample (N=466) was composed of students who responded in both October 2021 (Time 1) and October 2022 (Time 2) with the same longitudinal code (N=457), and of those who responded in both October 2022 (Time 1) and October 2023 (Time 2) but not in 2021 and 2022 (N=515; see Figure 1 for data inclusion process).

2.2. Ethics

The study was authorized by the “National Commission for Information Technology and Civil Liberties” with the number u24-20171109-01R1. All participants were informed about the study (purpose of the study and data collection) prior to their inclusion and provided their written informed consents, in accordance with the Declaration of Helsinki (Cook et al., 2003). The Ethical Principles of Psychologists and Code of Conduct of the American Psychological Association (American Psychological Association, 2016) for the ethical treatment of human participants were respected for all participants.

2.3. Measures

Participants were invited to complete an online survey twice during a one-year longitudinal study, at Time 1 and Time 2. The online survey assessed sociodemographic variables such as age and sex, as well as various scales and questionnaires measuring FAD, risk of eating disorders, physical activity, alcohol consumption and risk of alcohol-related problems (see Table 1 for more details).

2.3.1. Food and Alcohol Disturbance (FAD)

FAD was assessed with the 21 Likert-scale items of the French version of the CEBRACS (Ritz et al., 2023). The CEBRACS aims at investigating compensatory eating behaviors in relation to alcohol consumption over the past three months, intended to compensate for alcohol-related calories intake and/or to enhance the intoxicative effects of alcohol consumption. Each of the three time periods (before drinking, while under the effects of alcohol (during drinking), and after the effects of alcohol have worn off (after drinking) evaluates recourse to the same compensatory behaviors with items including eating less than usual, skipping meals or entire days of eating, eating low-fat or low-calorie food, exercising, vomiting, and using diuretics or laxatives. For each item, the participants were asked to indicate the frequency of the behavior: 1 = never; 2 = rarely (approximately 25% on occasions); 3 = sometimes (approximately 50% on occasions); 4 = often (approximately 75% on occasions); 5 = nearly always.

The CEBRACS is divided into four factors: “alcohol effects”; “dietary restraint and exercising”, “purging” and “extreme fasting and vomiting” (Ritz et al., 2023). The total score ranges from 21 to 105 points. A CEBRACS total score >21 points is considered as the cut-off point, reflecting an engagement in FAD behaviors (Knight et al., 2017; Moeck & Thomas, 2021; Pietrabissa et al., 2018; Pinna et al., 2024; Rahal et al., 2012; Ritz et al., 2023).

2.3.2. Risk of eating disorders

The SCOFF questionnaire was used to assess the risk of developing eating disorders in at-risk and student populations (Garcia et al., 2010, 2011). The questionnaire consists of five dichotomous questions (“yes” or “no” answers), with a total score ranging from 0 to 5. The established threshold is of at least two positive answers. The SCOFF sensitivity and specificity were 94.6% and 94.8% respectively for eating disorders in the student population (Garcia et al., 2010). Participants were also surveyed about their use of laxatives, dietary restraint, and exercise to burn calories over the past three months. Responses were measured on a scale from “never” (0) to “very often” (4) for each behavior.

2.3.3. Physical activity

The participants were asked about their physical activity, and a composite score was calculated based on the number of hours per week they exercised and the intensity of their exercise sessions, scored from “very low” (1) to “very high” (5).

2.3.4. Risk of alcohol-related problems and alcohol consumption

The French version of the Alcohol Use Disorders Identification Test (AUDIT; Gache et al., 2005), which consists of 10 items, was used to assess the risk of alcohol-related problems. Each question is scored from 0 to 4, with a maximum AUDIT score of 40. The AUDIT has been validated and recommended as an effective measure of alcohol use disorder in university students (Demartini & Carey, 2012). In primary care, a cut-off point superior or equal to 20 prompts referral for diagnostic evaluation and treatment of alcohol dependence (Babor et al., 2001). The study participants were interviewed to determine the age at which they started consuming alcohol, the amount of alcohol they consume per week (in standard drinks), and the frequency of their drinking in a typical week (ranging from 1 to 7 days).

2.4. Data analyses plan

The normality of the distributions for the CEBRACS total score and scores of each CEBRACS subscale was assessed using both skewness and kurtosis parameters. Results showed a violation of normality (values >|2|) for all the variables and non-parametric statistics were thus used in the subsequent analyses.

Descriptive statistics were used on the CEBRACS total score to describe the prevalence of FAD among university students at Time 1 and Time 2.

To assess *the evolution of FAD frequency* among university students over a one-year period, comparisons between the CEBRACS total score and the scores of the each CEBRACS subscale between Time 1 and Time 2 were assessed using the Wilcoxon rank test. To prevent type I error, Bonferroni correction was applied ($p \leq 0.01$ for 5 comparisons).

To determine *the evolution of FAD prevalence* between Time 1 and Time 2, a variable was computed as follows (see Table S1 for more details): individuals with a positive FAD at Time 1 (total CEBRACS score > 21) and a negative FAD score at Time 2 (CEBRACS score $= 21$) were coded as -1 (FAD-remission). Individuals with a negative FAD score at Time 1 and a positive FAD score at Time 2 were coded as 1 (FAD-onset). Participants who did not experience any change between Time 1 and Time 2 (Positive FAD score or negative FAD score at both times) were coded as 0 (Stable). The coding was also applied to the CEBRACS subscales (see Table S1). The prevalence of FAD-remission, FAD-onset and stable participants was reported. One-sample Wilcoxon rank tests were conducted on these coded variables to determine whether significant changes occurred in students' FAD onset or remission between Time 1 and Time 2. The same analyses were conducted only on FAD-positive participants at Time 1. Bonferroni correction was applied to prevent type I errors ($p \leq 0.01$ for 5 comparisons).

To determine *the predictors (at Time 1) related to changes in FAD onset or remission between Time 1 and Time 2*, in all the participants, multinomial logistic regression analyses were conducted. The independent variables included demographic variables (age and gender), as well as scores assessing the risk of eating disorders, physical activity, and alcohol-related problems (as described in Table 1). The reference was set at 0 for participants who did not change between Time 1 and Time 2 (Stable). Analyses were conducted on the coded variables of the CEBRACS total score and each CEBRACS subscale. To avoid multicollinearity, Spearman correlations were analyzed. Correlation coefficients with an absolute value of $\rho > 0.7$ were considered as being suggestive of multicollinearity (Godefroy et al., 2014). This statistical methodology has already been conducted in studies on depression (Agosti, 2014; van der Veen et al., 2021; Wassink-Vossen et al., 2019), obsessive-compulsive disorder (Geiger et al., 2024), suicidal ideation (Mulholland et al., 2023) and hospital survivors with COVID-19 (Huang et al., 2021).

To examine whether *the predictors of FAD evolution over a one-year period evolved parallel to FAD behaviors*, the variables identified in the previous analysis were then compared

between FAD-remission, FAD-onset and Stable participants based on the CEBRACS total score. To accomplish this, each variable was transformed as follows: $Score\ Time\ 2 - Score\ Time\ 1$. A positive score reflects an increase between Time 2 and Time 1, a negative score indicates an improvement between Time 1 and Time 2, and a score of 0 reflects no change between Time 1 and Time 2. The computed variables were then compared using one-way Kruskal-Wallis ANOVAs, and post-hoc comparisons were made using Dwass-Stell tests. Bonferroni correction was applied to prevent type I-errors.

3. Results

3.1. Evolution of FAD over the one-year longitudinal follow-up

No significant differences were found in all the participants on the *frequency of FAD* assessed with the CEBRACS total score and the scores of each of the CEBRACS subscales between Time 1 and Time 2 (Figure 2). The descriptive statistics are summarized in Table 1. When analyses were conducted only with FAD-positive participants at Time 1, no significant differences were found after Bonferroni correction ($p \leq 0.01$ for 5 comparisons). When a less stringent correction was applied, significant change was observed on the CEBRACS total score between Time 1 and Time 2 ($p=0.02$; rank biserial correlation = 0.35, medium effect size), as well as on the “dietary restraint and exercising” ($p=0.03$; rank biserial correlation = 0.36, medium effect size) and “extreme fasting and vomiting” ($p=0.02$; rank biserial correlation = 0.70, large effect size) subscales (Figure S1). Scores were significantly lower at Time 2 compared to Time 1.

Regarding the *prevalence of FAD*, at Time 1, 13.3% of the participants (N=62) had a CEBRACS total score > 21 points. At Time 2, 15.7% of the participants (N=73) had a CEBRACS total score > 21 points. The prevalence of FAD-onset, FAD-remission and Stable between Time 1 and Time 2 based on the CEBRACS total score and each subscale is reported in Table 2. One-sample Wilcoxon rank tests conducted on all the participants on the change between Time 1 and Time 2 (-1; 0; 1) based on the CEBRACS total score did not yield significant results ($p=0.19$). No significant results were found for the analyses on the CEBRACS subscales (all p values > 0.05; Figure S2). However, significant results were found when analyzing only the FAD positive students at Time 1 to determine their evolution at Time 2, based on the CEBRACS total score ($t_{61} = -7.32$; $p \leq 0.001$; Cohen’s $d = 0.93$, large effect size). Analysis also revealed significant results for two subscales: “alcohol enhancement” ($t_{61} = -4.86$; $p \leq 0.001$; Cohen’s $d = 0.62$, large effect size) and “dietary restraint

and exercise” ($t_{61} = -4.12$; $p \leq 0.001$; Cohen’s $d = 0.52$, large effect size). Thus, students who were FAD positive at Time 1 become significantly FAD-remission at Time 2 and were significantly less likely to engage in FAD behaviors, more precisely, “alcohol enhancement” and “dietary restraint and exercising”. Results remained significant after Bonferroni correction ($p \leq 0.01$ for 5 comparisons).

3.2. Predictors of FAD changing between Time 1 and Time 2

Spearman’s correlation analyses revealed inter-correlations between the AUDIT score and both the number of standard drinks per week ($\rho = 0.79$) and the number of days per week of alcohol consumption ($\rho = 0.81$). Therefore, only the AUDIT score was used in the subsequent statistical analysis to avoid multicollinearity. Table 3 and Figure 3 present the results of the multinomial logistic regression analyses conducted on the coded variables of FAD evolution between Time 1 and Time 2 (-1: FAD-onset; 0: Stable; 1: FAD-remission) with demographic variables and the variables described in table 1 as predictors. The CEBRACS purging subscale was not included in the analyses due to the low number of participants who became FAD positive at Time 2.

The frequency of laxative/diuretic use at Time 1 was a significant predictor of FAD-remission for all the CEBRACS scores considered, except for the “alcohol enhancement” subscale. More specifically, the higher the use of laxatives/diuretics at Time 1, the greater the chance of becoming FAD-remission at Time 2. FAD-remission was also predicted by the AUDIT score (see Figure S3) and the frequency of exercising to lose weight. The probability of being FAD-remission at Time 2 increased in line with higher AUDIT scores and more frequent exercise at Time 1. Note that sex was also a predictor of FAD-remission, a finding to be treated with caution given the small number of women (2% of the participants) in FAD-remission at Time 2.

The frequency of dietary restraint, the AUDIT score (see Figure S3) and the SCOFF score at Time 1 were found to be significant predictors of FAD-onset at Time 2. Specifically, the higher the frequency of dietary restraint, the higher the AUDIT score and, the higher the SCOFF score at Time 1, the greater the probability of being FAD-onset at Time 2.

When re-ran these analyses removing participants who were FAD stable (FAD at both T1 and T2; $N = 33$) to consider the reference (at 0) with only non-FAD stable individuals. The results remained unchanged.

3.3. Evolution of the FAD predictors over a one-year period

The frequency of laxative/diuretic use, exercising to lose weight, dietary restraint, the AUDIT score, and the SCOFF score were found to be significant predictors of changes in FAD. Each variable was transformed as described in the statistical analyses section to consider the evolution between Time 1 and Time 2. The comparisons between the three groups (FAD-onset, Stable, and FAD-remission) using one-way Kruskal-Wallis ANOVAs showed significant results for the AUDIT score ($p \leq 0.001$; $\epsilon^2 = 0.13$, large effect size) and the frequency of dietary restraint ($p = 0.002$; $\epsilon^2 = 0.03$, small effect size) (Figure 4). Dwass-Steel post-hoc analysis revealed that the AUDIT score was reduced between Time 1 and Time 2 in FAD-remission compared to Stable and FAD-onset. The AUDIT score was highest at Time 1 in FAD-onset compared to Stable. FAD-onset also showed a reduced of dietary restraint between Time 1 and Time 2 compared to FAD-remission. No other statistical comparisons were significant.

4. Discussion

This study aimed to longitudinally assess FAD among university students over 1 year and to identify significant predictors and changes in FAD behaviors.

None of the included university students showed a significant change in the frequency of FAD behaviors as assessed by the CEBRACS total score and CEBRACS subscales over the course of one year. Similarly, there were no significant changes in engagement or disengagement in FAD behaviors. However, a significant reduction in FAD engagement was observed among students who were FAD-remission after one year, particularly for motives related to alcohol enhancement and dietary restraint. These initial findings indicate that it is important to take into account not only the CEBRACS total score, but also the cut-off score of each CEBRACS subscale when screening FAD students. Indeed, the distinct motives and behaviors associated with FAD, as assessed by the different CEBRACS subscales, are likely to evolve differently in university students.

For the first time, this study examines the predictors of FAD evolution over a one-year longitudinal follow-up.

FAD-remission

The results show that the main predictors of disengagement in FAD behaviors after one year are the AUDIT score, the frequency of laxative/diuretic use, and exercising to lose weight at baseline (Figure 5). More precisely, they revealed that individuals with higher AUDIT scores and more frequent bouts of disordered eating at baseline were more likely to be in FAD-remission one year later. The results are surprising and contradict previous cross-sectional

studies showing that alcohol-related problems (Choquette, Ordaz, et al., 2018; Horvath et al., 2020; Hunt & Forbush, 2016), laxative use, and excessive exercise are associated with FAD behaviors (Hunt & Forbush, 2016; Pompili & Laghi, 2018b). In our study, the risk of developing eating disorders at baseline is a strong predictor of FAD-remission after one year, notably in the disengagement from dietary restraint and extreme fasting behaviors. Surprisingly, this finding highlights the fact that an increased risk of eating disorders is associated with FAD-remission, specifically in terms of disengagement from FAD-related disordered eating. However, unlike FAD, the risk of eating disorders remains stable after one year and does not appear to evolve concomitantly with FAD-remission. One possible explanation is that FAD may be, at some point in the lives of certain individuals, a behavioral expression of eating disorders and a result of a more complex dynamic between eating and alcohol use disorders. Indeed, the AUDIT, which screens individuals at risk for alcohol-related problems, is also a significant predictor of FAD-remission for all motives and behaviors. This FAD-remission is also associated with a significant reduction in the AUDIT score (Figure 5, green plot at the right). Overall, this finding suggests that a reduction of problematic alcohol use is accompanied by FAD-remission but individuals in FAD-remission remain at risk of suffering from eating disorders one year later.

FAD-onset

In contrast, the frequency of dietary restraint and the SCOFF score are the main predictors of FAD-onset at one year. Higher scores are associated with a greater likelihood of developing FAD (see Figure 5). Previous studies have reported that the risk of eating disorders is specifically associated with FAD behaviors involving dietary restraint and extreme fasting (Hunt & Forbush, 2016; Pietrabissa et al., 2018; Pompili & Laghi, 2018b; Ritz et al., 2023). Although the risk of eating disorders assessed by the SCOFF score remains stable at one year, the frequency of dietary restraint is reduced in FAD-onset compared to FAD-remission (see Figure 5, yellow plot). In contrast to the studies cited above, FAD-onset is not accompanied by a higher risk of eating disorders, but rather a reduction in dietary restraint. Thus, engaging in FAD behaviors may not only be related to an increased risk of eating disorders. Alcohol-related problems at baseline (assessed with the AUDIT) also predict the FAD-onset and increase in these FAD individuals over the course of a year's follow-up (see Figure 5, green plot at the left). However, as shown in Figure S3, FAD-onset is only associated with an AUDIT score of up to 19 points; the probability of FAD-onset decreases with an AUDIT score of 20 points or higher, which warrants further diagnostic evaluation for alcohol use disorder (Babor et al., 2001). This implies that heavy alcohol use may increase the risk of

engaging in FAD, possibly leading to alcohol use disorder becoming the primary concern. The findings suggest, on one hand, that individuals who are at risk of developing eating disorders and engage in heavy alcohol use may also be at risk of FAD behaviors. On the second hand, students who are at risk of alcohol-related problems may be less likely engage in FAD, but they are more likely to be at risk of developing alcohol use disorders.

Strength and limitations

This longitudinal study is the first to examine FAD behaviors over the course of a year and investigate the significant predictors of FAD-onset or FAD-remission in a longitudinal follow-up. The study includes FAD measures, as well as alcohol use, alcohol-related problems, and risk for eating disorders measures. These findings contribute to a better understanding of the predictors of FAD behaviors.

There are two main limitations to our study. Firstly, the prevalence of FAD in our sample is relatively low compared to a previous study conducted in the French population (Choquette, Ordaz, et al., 2018). However, our FAD prevalence is similar to that of studies conducted in the Italian population (Pompili & Laghi, 2018b, 2018a). Secondly, one year is a relatively short period for a longitudinal follow-up to examine changes in FAD and to consider the role and the evolution of different predictors in FAD onset or remission. Conducting a longitudinal study with sufficient respondents year by year through online surveys can be challenging.

Conclusion and future studies

This study demonstrates that there is minimal change in FAD behavior during the one-year follow-up period. FAD-positive students tend to disengage from FAD after one year, especially regarding alcohol enhancement and dietary restraint. Antecedent risk for eating disorders, dietary restraint, and heavy alcohol use are associated with FAD-onset after one year. The longitudinal follow-up indicates that FAD-onset is concomitant with a reduction in food deprivation while the risk of eating disorders remains and the risk of alcohol-related problems increases. This suggests a complex relationship between alcohol use and disordered eating which may lead to a greater vulnerability to FAD and a more severe risk of alcohol use disorder.

FAD-remission at one year is associated with purging, dysfunctional exercise, and heavy alcohol use at baseline. FAD-remission in students is accompanied by a reduction in the risk of alcohol-related problems, but not for eating disorders. These findings suggest that the FAD-remission may increase the risk of chronic eating disorders. These findings have several clinical implications. They highlight the need for vigilance regarding FAD behaviors and the risk of eating and alcohol use disorders as predictors of FAD onset or remission. Prevention

strategies should focus on managing laxative/diuretic use, dietary restraint, or dysfunctional exercise in FAD students. Additionally, reducing earlier alcohol use can help to prevent the onset of FAD and the development of alcohol use disorder and related problems later.

Future studies with longer longitudinal follow-up are needed to better understand the dynamics of FAD engagement or remission, also including the potential relationships with levels of anxiety, impulsivity, depression, self-esteem and drinking motives. The prevalence of FAD and its associated predictors have never been studied in clinical samples of patients with alcohol use and/or eating disorders. Conducting such studies would provide a deeper understanding of FAD behaviors in different populations.

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7. Tables

Table 1: Sample characteristics of the participants

Variables	Time 1	Time 2
Age <i>Range</i>	20.0 ± 2.51 18-35	21.0 ± 2.51 18-35
Sex (Men/Women)	137/329	
<i>FAD</i>		
CEBRACS total score <i>Range</i>	22.00 ± 3.60 21-48	22.01 ± 4.14 21-68
CEBRACS “enhance the alcohol effects” factor <i>Range</i>	7.57 ± 2.37 7-27	7.67 ± 2.60 7-28
CEBRACS “dietary restraint and exercising” factor <i>Range</i>	7.40 ± 1.77 7-22	7.43 ± 1.90 7-30
CEBRACS “purging” factor <i>Range</i>	5.00 ± 0.00 5-5	5.03 ± 0.65 5-19
CEBRACS “extreme fasting and vomiting” factor <i>Range</i>	2.04 ± 0.29 2-5	2.03 ± 0.22 2-5
<i>Risk of eating disorders variables</i>		
SCOFF <i>Range</i>	0.81 ± 1.02 0-4	0.80 ± 1.08 0-5
Frequency of laxatives/diuretic uses <i>Range</i>	0.02 ± 0.18 0-3	0.03 ± 0.26 0-3
Frequency of dietary restraint <i>Range</i>	0.58 ± 1.17 0-4	0.57 ± 1.16 0-4
Frequency of exercising to lose weight <i>Range</i>	0.28 ± 0.84 0-4	0.21 ± 0.75 0-4
<i>Physical activity</i>		
Number of hours per week* intensity <i>Range</i>	5.36 ± 8.71 0-60	6.76 ± 9.91 0-60
<i>Alcohol consumption</i>		
AUDIT <i>Range</i>	5.40 ± 2.49 0-31	3.16 ± 5.43 0-36
Age of onset <i>Range</i>	15.40 ± 2.08 6-20	
Number of standard drinks per week <i>Range</i>	2.01 ± 5.44 0-50	2.01 ± 6.21 0-70
Number of day per week of alcohol consumption <i>Range</i>	0.71 ± 1.20 0-7	0.78 ± 1.22 0-7

Data are shown as mean ± standard deviation

FAD: Food and Alcohol Disturbance; CEBRACS: Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale; AUDIT: Alcohol Use Disorders Identification Test

Table 2: Prevalence of FAD-onset, FAD-remission and Stable between Time 1 and Time 2

CEBRACS scores	FAD-onset	FAD-remission	Stable
CEBRACS total score	8.6%	6.2%	85.2%
CEBRACS alcohol subscale	6%	5.4%	88.6%
CEBRACS dietary and exercising subscale	6.2%	4.5%	89.3%
CEBRACS purging subscale	0.2%	0%	99.8%
CEBRACS extreme fasting and vomiting subscale	1.3%	1.7%	97%

FAD: Food and Alcohol Disturbance; CEBRACS: Compensatory Eating and Behaviors in Response to Alcohol Consumption Scale

Table 3: Significant predictors at Time 1 of the evolution of FAD engagement between Time 1 and Time 2

Predictors	Ref 0 ¹	Model fit (R ² MCF)	FAD-remission (coded -1)		FAD-onset (code +1)		
			β; OR [95% CI]	<i>p</i>	β; OR [95% CI]	<i>p</i>	
<i>CEBRACS total score</i>							
Age		12.3%		0.94		0.91	
Gender (M-F)				0.73		0.30	
Scoff				0.52		0.69	
Frequency of laxative/diuretic uses				1.00; 2.71 [1.00-7.53]	0.05		0.74
Frequency of dietary restraint					0.46	0.31; 1.37 [1.04-1.80]	0.02
Frequency of exercising to lose weight					0.60		0.23
AUDIT				0.17; 1.18 [1.12-1.25]	≤0.001	0.07; 1.07 [1.01-1.13]	0.02
Exercising (intensity * hours)					0.79		0.25
<i>CEBRACS alcohol subscale</i>							
Age		17.3%		0.85		0.39	
Gender (M-F)				0.47		0.76	
Scoff				0.76		0.40	
Frequency of laxative/diuretic uses				0.98; 2.68 [0.89-8.08]	0.08*		0.73
Frequency of dietary restraint					0.27		0.21
Frequency of exercising to lose weight				0.50; 1.65 [0.99-1.03]	0.06*		0.37
AUDIT				0.21; 1.23 [1.15-1.31]	≤0.001	0.07; 1.08 [1.01-1.16]	0.02
Exercising (intensity * hours)					0.33		0.38
<i>CEBRACS “dietary restraint and exercising” subscale</i>							
Age		16.3%		0.65		0.56	
Gender (M-F)				0.54		0.20	
Scoff				-0.65; 0.52 [0.26-	0.07*		0.35

			1.06]			
Frequency of laxative/diuretic uses			2.05; 7.76 [2.31-26.09]	≤0.001		0.67
Frequency of dietary restraint			-1.06; 0.35 [0.11-1.07]	0.07*	0.34; 1.41 [1.04-1.91]	0.03
Frequency of exercising to lose weight			0.88; 2.41 [1.45;4.00]	≤0.001		0.18
AUDIT			0.16; 1.17 [1.01-1.25]	≤0.001	0.06; 1.06 [1.00-1.13]	0.05
Exercising (intensity * hours)				0.88		0.59
CEBRACS “extreme fasting and vomiting” subscale						
Age				0.89		0.20
Gender (M-F)			4.23; 66.88 [1.46-3249] ²	0.03		0.16
Scoff				0.13	0.92; 2.51 [1.04-6.08]	0.04
Frequency of laxative/diuretic uses			1.71; 5.53 [1.11-27.43]	0.04		0.39
Frequency of dietary restraint		44.8%		0.32		0.41
Frequency of exercising to lose weight				0.12		0.71
AUDIT			0.32; 1.38 [1.17-1.64]	≤0.001		0.54
Exercising (intensity * hours)				0.54	0.06; 1.06 [1.00-1.16]	0.08*

1: in the multinomial logistic regression analyses, the reference level was set as 0 (participants who did not change in FAD engagement between Time 1 and Time 2)

R² MCF: Mac Fadden’s R² in %

OR: Odd ratio [95% Confidence Interval]; β and OR were only reported for significant results

* tendency to significance (0.10<p<0.05)

² the 95% CI is large because there was only one man and 7 women FAD quitters for the “extreme fasting and vomiting” motive. Interpretation of this predictor should be considered with caution.

8. Figures

Figure 1: Flow chart of inclusion process

Figure 2: Distribution plots of the CEBRACS total score and scores of each CEBRACS subscales in participants at Time 1 and Time 2

Data are shown as marginal means \pm standard error

Figure 3: Significant predictors at Time 1 (risk of eating disorders, alcohol disorder and physical activity) of the evolution of FAD engagement (FAD remission or FAD onset) at Time 2

Figure 4: Distribution plots of the evolution of the significant predictors between Time 1 and Time 2 of the FAD change over the course of the one-year longitudinal follow-up

Data are shown as marginal means \pm standard error

-1: FAD remission; 0 Stable; +1: FAD onset

* significant difference at $p \leq 0.05$

Variable with a positive score reflects an increasing between Time 2 and Time 1, a negative score an improvement between Time 1 and Time 2 and a score =0 reflects no evolution between Time 1 and Time 2.

Figure 5: Significant predictors associated with FAD onset and FAD remission over one-year of longitudinal follow-up

Higher frequency of dietary restraint, risk of eating disorders assessed by the SCOFF and alcohol-related problems assessed by the AUDIT at Time 1 were associated with higher FAD onset one year later. FAD onset is accompanied by a reduction in the frequency of dietary restraint but more alcohol-related problems.

Higher frequency of laxative use and dysfunctional exercise in FAD individuals at Time 1 was associated with higher probability of FAD remission one year later. FAD remission is accompanied by a reduction in alcohol-related problems. Individuals in FAD remission may still be at risk for eating disorders.